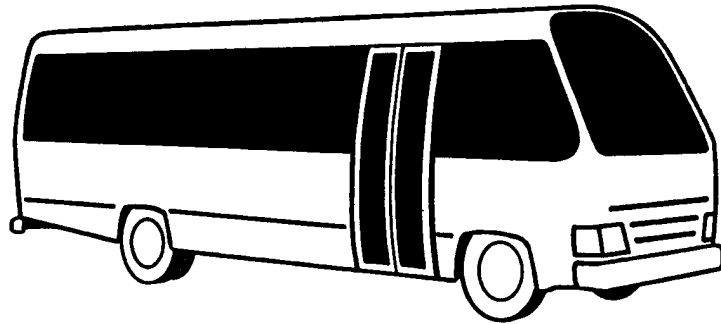


# STATE OF MICHIGAN PUBLIC TRANSPORTATION



## MEDIUM DUTY DIESEL BUS SPECIFICATIONS

24 & 30 Passenger Non-lift Buses - Lift Buses with Alternate Seating, (25 & 29 Foot Buses, Respectively)

2000-2002



BUREAU OF URBAN AND PUBLIC TRANSPORTATION  
PASSENGER TRANSPORTATION DIVISION



# STATE OF MICHIGAN

## SPECIFICATIONS

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## MEDIUM DUTY DIESEL BUS SPECIFICATIONS

### STATE OF MICHIGAN PUBLIC TRANSPORTATION

24 and 30 Passenger Non-Lift - Lift Buses With Alternate Seating  
25 and 29 Foot Buses, Respectively

#### I. PURPOSE OF SPECIFICATIONS

The purpose of these specifications is to set forth the minimum requirements for medium-duty (7 year or 200,000 mile category) buses capable of seating 24 or 30 adult forward facing passengers and alternate capacity of ambulatory adult passengers and wheelchair passengers. As a minimum the vehicles must meet all applicable Michigan Motor Carrier Vehicle Codes, all applicable Federal Motor Vehicle Safety Standards (FMVSS), and Americans with Disabilities Act (ADA).

Any successful bidder supplying these vehicles shall quick title and deliver the vehicle and the title to the location specified by the state of Michigan, Bureau of Urban and Public Transportation. Chassis serial number, body number, axle ratio, gross vehicle weight rating (GVWR), seating capacity and paint codes shall be imprinted on a permanent decal or stamped on a metal plate and affixed in the driver's area of the vehicle (location to be approved by the State).

The bidder shall have a facility(ies) and personnel in Michigan or may subcontract with a prime Michigan firm(s) capable of handling final inspection and corrections required by the State prior to acceptance of the vehicles. Such facilities shall be established throughout the state for providing chassis and body service support to transit agencies to minimize agency travel to reach the nearest facility. The successful bidder must be capable of providing parts and service for a period of ten years after the vehicles have been placed in service throughout the state of Michigan. The successful bidder must be able to supply replacement parts within 5 working days of a request by transit agency unless bidder notifies transit agency that the part is not available for shipment and provides the shipping date when the part will be available.

Regardless of options and seating plan ordered, the successful bidder shall be responsible for certifying that all vehicles delivered: 1) shall not exceed 95% of front spring and 95% of rear spring capacity rating at ground without exceeding GVWR of chassis as bid (determined by engineering calculated loaded vehicle axle weights); 2) bus length when measured bumper to bumper excluding the energy absorbing portion of the bumper shall not exceed 26' 8" for the 25 foot bus and shall not exceed 29' 11" in length for the 29 foot bus. Manufacturers shall comply with chassis company quality vehicle manufacturing programs such as Ford's Quality Vehicle Modifier(QVM).

In these specifications any required approvals shall be made by the State. Wherever brand, manufacturer, or product names are used, they are included only for the purpose of establishing a description of minimum quality of the item. This inclusion is not to be construed as advocating or prescribing the use of any particular brand or item or product. When an approved equal is requested, the bidder must demonstrate the quality of its product to the State, and must furnish sufficient technical data, test results, and the like, to enable the State to determine whether the bidder's product is or is not equal to that specified. All

requests for approved equals must be submitted with the bid and will be considered when bid evaluations are made.

## II. BODY SPECIFICATIONS

### A. General Design and Construction

**SAFETY:** The chassis and body shall be designed using only prudent, proven engineering principles with all work performed only by professional established, firms. The vehicle purchased shall comply with all state regulations and requirements applicable to the design and manufacture of motor vehicles.

**DRIVER SIZE and COMFORT:** Design criteria of bus purchased shall be for all females from the 5th percentile, to males of the 95th percentile, to be equally as comfortable in using all controls required to safely drive and maneuver the bus. All driver controls shall comply with FMVSS 101, with hand and foot controls required to operate the vehicle safely, including the placement of exterior adjustable mirrors, positioned to meet this safety requirement.

**QUALITY of WORKMANSHIP:** All labor employed in both the manufacturing and assembly processes of the vehicle purchased shall be to the highest industry standards. The entire vehicle shall be within all established engineering tolerances set by all parties involved in the design and production of the bus. All added components shall be installed and positioned according to the component manufacturer's installation procedures (available upon request).

**WELDING:** All welding procedures used throughout the construction of the vehicle, including materials, qualifications and training of personnel, shall be in accordance with the standards of the American Society for Testing and Materials (ASTM) and the American Welding Society (AWS). Contact surfaces of all material to be welded shall be clean, and free of grease, paint, rust and scale. After welding, all rough edges and surfaces on parts shall be ground smooth and coated with a corrosion inhibiting primer and paint.

**ATTACHMENT HARDWARE:** All rivets, screws, bolts, nuts, washers and/or other types of fasteners used in the construction process shall be of appropriate size and strength rating for the application. All fasteners that would be exposed to the elements (floors, exterior, stepwell, etc) shall be sprayed with or dipped in a rust-resistant coating material, or be cadmium or zinc plated, or be stainless steel, or otherwise be made of rust-resistant type material all of which will pass the 1000 hour ASTM D117 Salt Spray test and the 1000 hour ASTM D2247 Humidity Resistance test. Fasteners used by the respective component manufacturers in their assemblies would be acceptable as part of the assembly.

### B. Body Structure and Exterior Panels

#### 1. Metal Rollover Frame, Cage-type Construction

- a. The coach shall have a heavy-duty unit body-type structure. The body structure (rollover frame, cage type) shall be of durable



steel or aluminum construction, adequately reinforced at all joints and points of stress, with sufficient strength to comply with the FMVSS 220 rollover protection test. All body and floor structural members (tubes, channels etc.) shall be Gas Metal Arc Welded (GMAC) or equal at each joint. Each bidder shall provide certification with the bid that the vehicle as bid meets the FMVSS 220 rollover protection test (see Section VIII).

- b. The bus shall be designed to withstand road shocks, stop and start operations, and other conditions found in Michigan transit bus service. The body shall be securely fastened to the chassis frame structure using a method of uniform attachment to the chassis frame so that the entire body and frame shall act as one unit without any movement in joining. Roof, side, front, and back panels shall be secured to the floor structure and body vertical and horizontal frame members to result in a permanent, fully-integrated structural unit adequately reinforced with posts and rails at all points where stress concentration may occur. The body floor subframe assembly, including lower skirt reinforcements, shall be gage number 14 (.075" thickness) minimum galvanized steel (mill applied), stainless steel, aluminum, or cold or hot rolled steel with corrosion resistant coating, each of which shall have equal mechanical and corrosion resistance properties as gage number 14 galvanized steel as a minimum. Wheelwells shall have minimum yield strength of gage number 14 (.075" thickness) galvanized steel, gage number 16 (.060" thickness) stainless steel, or gage number 12 (.10" thickness) aluminum properly welded or secured with approved corrosion resistant fasteners to the floor structure. Wheelwells may be made of fiberglass reinforced plastic (FRP) material that is equal to gage number 14 galvanized steel. The entire body cage and frame including floor structure shall be properly coated with a corrosion resistant coating or a non water permeable primer/paint. All steel (except stainless steel) box type tubing used in the floor structure shall have the interior of the tube coated with corrosion resistant material equal to Ziebart Type A. All components treated to resist corrosion shall be properly cleaned to remove greases, oils, and residues before application of the corrosion resistant material. When completed all body side sections and roof sections including structure shall be at a minimum 1¼" thick. Where body segments are joined they shall be properly sealed to prevent intrusion of drafts, fumes, dust, and water to the interior of the bus body.
- c. All exterior side and roof panels shall be gage number 20 (.035" thickness) galvanealed steel, or metal of equal mechanical properties, minimum. The corners, transitions, front panels, and other locations requiring additional strength shall use steel or other metal with mechanical properties to match the structural integrity requirements. If fiberglass it shall have as a minimum the mechanical properties equal to gage number 20 (.035" thickness) steel according to American Society of Mechanical Engineers (ASME) industry standards and must have

State approval. Reinforcements shall be installed around all door and all window openings in order to transfer stress around the opening. All door openings shall have full structural framing (tube) or imbedded reinforcements equal to the structural members of the body that will adequately support concentrations of stress around openings. Where a stiffener or a backer material (substrate) is used for the exterior panels, it shall be bonded with waterproof adhesive to the exterior panel; it shall be a water resistant material; and it must be thoroughly sealed from the elements when installed so that the substrate will not be exposed to or absorb moisture and cause corrosion to the interior of the panel or any body structure. Exterior panel stiffener or a backer material shall not be of wood composition, plywood or a pressed wood product. Where body segments are joined they shall be properly sealed to prevent intrusion of drafts, fumes, dust, and water to the interior of the bus body. When completed all body side sections and roof sections including structure shall be at a minimum 1¼" thick.

- d. All interior panels may be made of scuff-resistant vinyl-coated aluminum, textured paint on steel, or laminate/FRP finished material. Interior panels shall have as a minimum the physical properties of gage number 24 (.024" thickness) vinyl-coated aluminum. Interior panel threaded fasteners or rivets shall secure panels to body framing structure. Where fasteners are in the panels only, a reinforcing nut or reinforcing panel shall be installed for added strength and fastener retention.
- e. Exterior panels and lower skirt panels may be metal or fiberglass and shall be sufficiently stiff to prevent vibration, drumming, or flexing while the bus is in normal service. Body front and/or rear endcaps may be molded fiberglass panels (gel coat finish) installed with required structural framing or a FRP composite structure. Highly corrosion resistant metal lower-skirt panels shall consist of compatible materials not subject to electrolysis and shall be sufficiently fastened and braced to prevent damage from ice and snow build-up. Lower skirt panels shall be properly coated to resist corrosion (exterior and interior), see Section II., Part M., Rustproofing/Undercoating. Metal lower skirt panels may be one piece in length and shall be repairable in sections. Lower skirt panels shall not use a wood backing material for a panel stiffener. Where panels are lapped, the upper and/or forward panels shall overlap the lower and/or rearward panels to prevent intrusion of water under the panels. Sealing and fastening of panel joints, including front and rear cap-to-body joints, shall prevent entrance of moisture and dirt. Joint sealing shall be made through use of a non-shrinking bonding sealant; sealing shall not be solely dependent on an exterior trim strip or a trim cap. All exterior panels shall be buck riveted and/or bonded to the body frame structure. Exterior metal panels shall be given a thorough anti-corrosion treatment.

- f. The outside body panels shall have on each side one heavy-duty rubrail. Rubrails shall be extruded solid aluminum with a flexible, rubber-type resilient material insert (minimum 1½" x ½") or 1½" x ½" minimum solid rubber-type of flexible, resilient material. Rubrails shall be located no less than 25" nor more than 43" above the ground on each side. Rubber fender splash guards shall be installed on front and rear wheel openings. Where the rubrails and fender opening guards are not an integral part of the body, installation of rubrails and fender opening splash guards shall be made after the finish coat of paint is applied to the bus.
- g. Gun installed huckbolt fastenings, buck rivets, threaded fasteners appropriate for the application, bonding adhesives, or approved equivalent shall be utilized on all exterior body panels, rubrails, and all other locations where stress is concentrated. Where huckbolts or rivets cannot be used, threaded fasteners appropriate for the application may be used; such as for rubrails, trim strips, and rubber fender splash guards. Fastener materials shall be compatible with materials being fastened and meet the 1000 hour ASTM D117 Salt Spray test and the 1000 hour ASTM D2247 Humidity Resistance test. Where self-tapping bolts are used, body panels shall be reinforced with steel backing, aluminum backing, or stainless steel backing which are equal to materials used for the lower skirt reinforcements. In no case shall the sealing of the panels be dependent on caulking alone.
- h. Window openings cut into body panels shall have a maximum total clearance of C" around retention frame (1/16" on each side) to minimize the need for caulking (see Section II. V., Windows Item 1). All openings cut into metal body exterior panels must have the exposed cut edges primed or properly coated to inhibit corrosion formation before further assembly or painting occurs.

## **2. Fiberglass Reinforced Plastic (FRP) Composite Unitized-type Body**

- a. The coach body shall have a heavy-duty unitized structure and shall be of durable fiberglass reinforced plastic (FRP) composite construction. The body panels shall consist of an exterior high gloss gelcoat (.020" thickness, minimum) on a resin-hardened FRP (3/32" thickness, minimum) attached to a center layer of resin hardened Verticel® or equal honeycomb (f" thickness, minimum) with an inner FRP panel (3/32" thickness, minimum); or may be ¾" polyurethane foam insulation gelcoated to ¼" FRP exterior with ¼" FRP interior, reinforced with steel perimeter and transverse supports, completely fiberglassed to adjoining body parts. It shall be adequately bonded and mechanically fastened at all joints and points of stress with sufficient strength to comply with the FMVSS 220 rollover protection test. Each bidder shall provide certification with the bid that the vehicle as bid meets the FMVSS 220 rollover protection test (see Section VIII).

- b. The bus shall be designed to withstand road shocks, stop and start operations, and other conditions found in Michigan transit bus service. The body shall be securely fastened to the chassis frame structure using a method of uniform attachment to the chassis frame so that the entire body and frame shall act as one unit without any movement in joining. Side and back panels shall be secured to the floor and lower body frame members; all of which shall result in a permanent, fully-integrated structural unit adequately reinforced at all points where stress concentration may occur. The body floor subframe assembly, including lower skirt reinforcements, shall be gage number 14 (.075" thickness) minimum galvanized steel (mill applied), stainless steel, aluminum, or cold or hot rolled steel with corrosion resistant coating, each of which shall have equal mechanical and corrosion resistance properties as gage number 14 galvanized steel or spray coating treated steel as a minimum. Wheelwells shall have minimum yield strength of gage number 14 (.075" thickness) galvanized steel, gage number 16 (.060" thickness) stainless steel, or gage number 12 (.10" thickness) aluminum properly welded or secured with approved corrosion resistant fasteners to the floor structure. Wheelwells may be of FRP material that is equal to gage number 14 galvanized steel. The entire body frame including floor structure shall be properly coated with a corrosion resistant coating or a non water permeable primer/paint. All steel (except stainless steel) box type tubing used in the floor structure shall have the interior of the tube coated with corrosion resistant material equal to Ziebart Type A. All treated components shall be properly cleaned to remove greases, oils, and residues before application of the corrosion resistant material. The vehicle shall adequately carry loads for which it was designed without exceeding its GVWR.
- c. All exterior side and roof panels when completed shall be at a minimum of 1C" thick. The side walls, rear endcap, roof, and front cap shall be interlocked by resin saturated fiberglass matting and mechanical fasteners, forming a unibody design without exposed fasteners or protruding moldings. Imbedded reinforcements shall be installed at all door openings in order to support door mounting hardware and door operating mechanisms. All door openings shall have full structural integrity equal to that of the body structure.
- d. Interior panels may be an integral part of the FRP composite panel. Where threaded fasteners are in the interior panel only an imbedded reinforcing nut or a reinforcing panel shall be integrated into the FRP composite for added strength and fastener retention.
- e. Exterior panels may be an integral part of the FRP composite panel. Exterior panels shall be sufficiently stiff to prevent vibration, drumming, or flexing while the bus is in normal service. Lower skirt panels shall be sufficiently fastened and braced to prevent damage from ice and snow build-up. Lower

skirt panel may be one piece and shall be repairable. Where panels are lapped, the upper and/or forward panels shall overlap the lower and/or rearward panels to prevent intrusion of water under the panels. Sealing and fastening of joints, including front and rear cap-to-body joints, shall prevent entrance of moisture and dirt. All exterior panels shall be bonded to the lower body frame.

- f. The outside body panels shall have on each side one heavy-duty rubrail. Rubrails shall be extruded solid aluminum with a flexible, rubber-type resilient material insert (minimum  $1\frac{1}{2}$ " x  $\frac{1}{2}$ ") or  $1\frac{1}{2}$ " x  $\frac{1}{2}$ " minimum solid rubber-type of flexible, resilient material. Rubrails shall be located no less than 25" nor more than 43" above the ground on each side. Rubber fender splash guards shall be installed on front and rear wheel openings. Where the rubrails and fender opening guards are not an integral part of the body, installation of rubrails and fender opening splash guards shall be made after the finish coat of paint is applied to the bus.
- g. No sheet metal screws shall be permitted, except for rubrails and rubber fender splash guards which can be secured with locking, self-tapping bolts. Fastener materials shall be compatible with materials being fastened and meet the 1000 hour ASTM D117 Salt Spray test and the 1000 hour ASTM D2247 Humidity Resistance test. Where self-tapping bolts are used in body panels the body panels shall have an imbedded reinforcing nut or a reinforcing panel shall be integrated into the FRP composite for added strength and fastener retention. In no case shall the sealing of the panels be dependent on caulking alone.
- h. Window openings cut into body panels shall have a maximum clearance of C" around frame,  $1/16$ " on each side, to minimize the need for caulking (see Section II. V., Windows). All openings cut into body exterior panels must have the exposed cut edges properly coated to inhibit moisture intrusion before further assembly or painting occurs.

**C. Passenger Door**

- 1. The manufacturer shall provide a heavy duty electrically operated passenger entrance door. The passenger entrance door shall be a split-type double leaf swing door. This door shall have a flexible soft rubber cushion on the meeting edge  $1\frac{1}{2}$ " in width, minimum. The door glass shall be see-through, tinted (AS-2) safety glass. As is practical for all operating conditions and vehicle speeds, a seal to prevent the intrusion of water, dust and air drafts shall be provided between the door and the stepwell, between the door and body opening, and between the door leaf sections. The door leading edge opening speed shall not exceed 18 inches per second and the closing speed shall not exceed 12 inches per second to provide a total door closing or opening in 2 to 4 seconds. The front passenger entrance door shall not extend below the step frame. The door shall be located on the right side of the vehicle. The entrance door shall provide a 30"

clear width opening, minimum. Door opening height from the top of the first step to the door header shall be a minimum of 76". Where interior height is low at the entrance header, the header shall be padded to prevent injury to those exiting the vehicle.

2. The electric door operator for the entrance door shall be located in an overhead compartment above the passenger entrance doorway; shall be concealed from passengers; and shall be easily accessible for servicing. The overhead compartment access panel for the operator shall be hinged or removable (secured with threaded fasteners retained by nut inserts). Door motor operation shall be limited electrically to control door travel at full open and full closed positions. Physical door stops shall only prevent marring or damage to doors and/or surrounding parts. A self-restarting manual release shall be provided to allow the entrance doors to be manually opened in the event of loss of electrical power or other emergency. The door operator motor shall not run continuously when the manual release is operated. Electric door operator, door linkage, and baseplate components shall be of a single manufacturer. Suggested source: Excell, Manufacturer's Standard, Vapor, or equal.
3. The passenger door control switch shall be located in the driver's compartment within easy reach of the driver and be clearly marked for "open" and "close" (switch shall operate the same on all buses). The control switch shall be powered by a constant battery feed circuit with circuit breaker protection. The control switch shall be "hold on" for operation.
4. A method shall be provided to lock the bus when it is not in use.

#### **D. Passenger Stepwell**

All steps and stepwells shall be gage number 14 (.075" thickness) stainless steel, minimum, with adequate structural bracing. All metal trim hardware in the stepwell area shall be stainless steel. All fasteners in the stepwell area shall be bright finished corrosion resistant coated/plated screws or stainless steel which will pass the 1000 hour ASTM D117 Salt Spray test and the 1000 hour ASTM D2247 Humidity Resistance test. Ground to first step shall not exceed 12" in height, each additional vertical step shall not exceed 9½" and all tread depths shall be 9" minimum. All steps in the entrance stepwell shall be of the same width. A suspension kneeling feature may be used to achieve the required 12" step height. Stepwells shall be covered with rubber (see Flooring, Section II. F.). Any exposed stainless steel shall be brushed, not painted.

#### **E. Interior**

1. The interior of the vehicle shall provide a pleasant, aesthetically pleasing atmosphere. The door and driver instrument panel are to be painted or otherwise finished with a nonreflective, anti-glare finish which matches the overall interior tones of interior panels. All interior hinged access doors shall use a ¼ turn thumb-style closing latch. All interior markings shall be durable materials affixed to the interior panels' smooth surfaces or markings shall be durable

materials affixed to metal plates fastened to the interior panels of the bus. The interior design and colors shall be approved at the Pre-Pilot Model Review Meeting described in the Production Schedule and Pilot Model & Plant Inspection sections of the bid Terms and Conditions.

2. All interior panels may be made of scuff-resistant, vinyl-coated aluminum, textured paint on steel, or laminate/FRP finished material. A light grey color shall be installed in the interior area above the seat rail lines, in the ceiling area, and on the rear endwall. Standard flooring material (coved to the floor) shall be installed on the sidewalls below the seat rail lines. All materials and treatments shall be easily cleaned. Panel fastening devices shall match color of panels. All interior finished surfaces shall be impervious to diesel fuel, gasoline, and commercial cleaning agents. Finished surfaces shall not be damaged by controlled applications of graffiti-removing chemicals.
3. The interior height of the passenger compartment at center aisle shall be 74" minimum. At 6" from the sidewall there shall be 67" of interior height, minimum, with a gradual contour to the center aisle (no bulkheads). Interior headroom at the back of bus (rear AC evaporator area) may be reduced to a minimum of 60 inches, but it shall increase to the normal ceiling height at the front of the rear seat cushion. The interior width at seat line shall be 90", minimum.
4. All surfaces, items, or hardware in the passenger compartment having sharp edges, corners, or angles that could cause injury, shall be padded with a heavy-duty, vinyl-covered, energy absorbing material to match interior colors. Areas of low headroom where a person is prone to strike his head shall be marked and padded. All handrails shall have rounded edges where exposed.
5. A storage area with a hinged access door shall be provided in the interior area above the windshield where space permits and when no destination sign is used. This area shall also be constructed to adequately support 60 pounds of two way radio communication equipment.

**F. Flooring**

1. The floor deck may be integral with the basic bus structure or mounted on the structure securely to prevent chafing or horizontal movement. All floor and deck fasteners shall be of corrosion resistant material and shall remain secured and corrosion resistant for the service life of the vehicle. The floor deck shall be ¾" C/D plywood of pressure treated exterior grade material or equal, minimum. A layer of sealer shall be installed between edges that butt against structural members and other deck sections to prevent dust and moisture intrusion. Passage holes provided for wiring and hoses shall be thoroughly sealed to prevent dust and moisture intrusion. No floor seat rail/track shall be installed in the wheelchair lift or wheelchair securement area. The floor deck upper surface shall have all cracks and voids filled and the whole surface rough sanded before installing the rubber flooring material. The floor deck, including the sealer, attachments,

and coverings, shall be waterproof, non-hygroscopic, resistant to wet and dry rot, resistant to mold growth, and impervious to insects.

2. The stepwell, entrance area, and center aisle floor area shall be overlaid with ribbed, slip resistant, oil resistant commercial RCA Rubber Transit-Flor® or equal, 1/8" floor and 3/16" step tread thickness.
3. The aisle to door area flooring joint shall make a miter so that aisle and door area flooring grooves line up for easy cleaning.
4. The 1/8" thickness flooring under the seats and in the wheelchair area shall be smooth, slip resistant, oil resistant RCA Rubber Transit-Flor® or approved equal. The flooring shall extend up the sidewall to the seat rail line and shall be coved at the floor/wall joint to form a smooth water tight transition. Flooring adhesive shall be oil resistant.
5. Step treads shall be one-piece ribbed rubber flooring with steel backing plate. Each tread shall have a band of bright yellow contrasting color molded in the full width of the step (must meet ADA contrast requirement). Step tread to stepwell joints shall be sealed to prevent intrusion of moisture and debris.
6. An aisle width standee line of bright yellow contrasting color shall be placed crosswise in the aisle just behind stepwell (must meet ADA contrast requirement). Standee decals shall be furnished and mounted at the center of the coach above the windshield.
7. Color of all flooring shall be as follows: RCA colors--Grey #766 or tan #747 or equal.
8. To provide easy access for service, the floor shall have a vapor and fumeproof bright aluminum diamond plate access panel to reservoir fill/check areas and fuel tank sending unit.
9. Wheelwells shall be thoroughly sealed to the floor and body to prevent intrusion of moisture and dirt. All wheelwells shall be covered with rubber flooring or molded fiberglass.

**G. Emergency Exits**

1. Each bus shall be equipped with a rear exit door with an opening of 1440 square inches or approximately 24" by 60" minimum (a rear exit window is optional). The rear door exit and side window exits shall meet federal requirements of FMVSS 217. The manufacturer shall provide a method to lock the rear exit door. The rear exit door shall have an audible alarm at the driver's area activated when the exit door latch handle starts to open and when the exit door is locked with the ignition on. A bus with a rear exit door shall have one small window on each side of the exit door in the rear endcap.
2. The rear exit door shall have an upper window and a lower window. The door glass shall be see-through, tinted (AS-2) safety glass. Door



window height shall match top of rear bus windows, one on each side of rear door. Door windows shall match design of bus rear windows. Heavy-duty door latch mechanism with handle guard shall provide a quick release for opening from inside and outside the vehicle but be designed to offer protection against accidental release. The door latch shall cause the door to compress the perimeter door seal to provide an airtight, dustproof and watertight seal around the door under all operating conditions and speeds. Door panels shall match exterior and interior body panels (see section II. A., B., and C.). All doors shall be fitted with bolted on heavy-duty stainless steel piano hinges or heavy duty hinges of a noncorrosive material. A restraint shall be installed to prevent the door from opening beyond 100° to prevent striking of the rear panel of the bus when the door is opened.

3. A passage way of 16" minimum width shall be provided to the rear exit door. No seats or other objects shall be placed in bus which restricts passageway to rear exit door.
4. One non-closing static exhaust vent, combination roof ventilatory-emergency escape hatch (23" by 23" minimum) shall be installed at the one-half point on the longitudinal center line of the roof of the passenger section of the bus. The roof vent/escape hatch shall provide fresh air inside the vehicle when opened and when the bus is in a forward motion. The vent/hatch shall have an inside and an outside release handle. Suggested source: 1100 series Transpec Inc., or equal.
5. All emergency exits shall be marked with instructions for proper use. All interior markings shall be durable materials affixed to the interior panels' smooth surfaces or markings shall be durable materials affixed to metal plates fastened to the interior panels of the bus.
6. Lever-type latches used for emergency windows shall secure the windows tightly shut, shall be easily operated, and shall not unlatch due to vibration during normal bus operation. The latches shall be made of non-corrosive materials and be designed for minimal maintenance needs.

#### **H. Gauges**

Chassis OEM gauges shall be used in the driver's instrument cluster, but if they are not available, VDO brand gauges, Stewart Warner gauges, or equal shall be used. Each vehicle shall have an instrument cluster with the following non-glare needle-type gauges which are easily monitored by sight from the driver's position (lights in lieu of gauges are not acceptable).

1. Voltmeter and its wiring shall be compatible with generating capacities.
2. Engine oil pressure gauge.
3. Engine coolant temperature gauge.

4. Fuel gauge.
5. Air system pressure gauge with low air warning alarm and light.

**I. Farebox (Small)**

1. The farebox (a donation box is optional) shall be mounted with the trip handle toward the driver and within easy reach of the driver. The farebox shall be mounted on an adequately braced stanchion, shall be located over a flat floor surface near the driver, and shall be accessible to passengers entering bus (meet ADA requirements). An amber or indirect farebox light shall be connected through an entrance door jamb switch to the running light circuit.
2. The farebox shall be lockable and supplied with two vaults that are interchangeable and lockable (2 keys for each lock). The vaults shall be keyed alike. The vault and farebox exteriors shall be marked with key reference. (Location shall be approved by the State at pilot model production.) Suggested source: Main Farebox Model M-4 or equal.

**J. Bumpers/Lifting Pads**

The vehicle shall be equipped with front and rear high energy absorbing bumpers. Both bumpers shall be installed per bumper manufacturer's specification and use a minimum Society of Automotive Engineers (SAE) grade 8 bolts in all attachment brackets. The front bumper's upper surface shall have an anti-slip surface. Bumper installation shall allow adequate space between the bumper and bus body for bumper energy absorption movement without body damage in impacts of 5 MPH or less. The space above the bumper left between it and the body shall be covered with a solid shield. Lifting pads shall be provided as part of the vehicle so that the vehicle may be lifted (at curb weight) at the front and the rear without any deformation or damage to the vehicle or bumpers and mounting hardware. Suggested source: Romeo R.I.M. Inc., H.E.L.P. bumper, or equal.

**K. Mud Flaps**

The vehicle shall have commercial grade anti-sail mud flaps/splash aprons behind front and rear wheels which contain no visible imprinted logo or advertising and shall extend to within 6" of the road surface at curb weight. Front mud flaps may be Chassis OEM supplied. The flaps/aprons shall be securely fastened with full width metal (3CR12 stainless or equal) strips and bolts (flap/aprons shall be compressed between bracket and metal strips). The mud flaps/aprons on all four wheels shall be at least 1" wider than the tire widths to stop splash at the rear of the wheel openings. Other mud flaps/splash aprons shall be installed where necessary to protect bus equipment (A/C components, batteries, front wheel inner shield, and the like) from road splash. Rubber fender splash guards shall be installed on the outer edge of all wheelwell openings.

**L. Towing**

Tow hooks shall be provided with two in the rear and two in the front of the bus, which shall be of sufficient strength to tow 1½ times the GVWR of the bus. Tow hooks shall be easily accessed and free of interference with bumper system when in use. Access to tow hooks may be made through holes in the bumper assembly. The intended use for tow hooks is only to safely move the bus to a point of tow truck hook-up. Tow hooks shall be installed to prevent them from dragging when the bus is driven over an incline. The tow hooks shall be mounted and adequately secured to the chassis frame as recommended by the tow hook manufacturer or may be supplied as standard equipment on the OEM chassis. The vehicle shall be designed to be towed from the front or from the rear. The bidder shall provide the towing and lifting procedure to be followed.

**M. Rustproofing/Undercoating**

When the unit is completed, the sections of the underside of the vehicle exposed to the elements shall be treated with an undercoating material except those areas of the OEM chassis where undercoating is not recommended. All steel box type tubing (except stainless steel) used in the floor structure and steel box type tubing (except stainless steel) wall structure below the window line shall have the interior of the tube coated with corrosion resistant material equal to Ziebart Type A. Sections that are treated shall be properly cleaned to remove greases, oils, and residues before application of the corrosion-proofing material. All mechanisms (moving or stationary parts) that are affected or rendered useless by an application of sealant or insulation shall be cleaned free of sealant or insulation including vent canisters and drain pipes. Rustproofing/corrosion-proofing shall be warranted for the same period covered by the body/structure warranty. Suggested source: Tectyl 121-B or equal for all sections other than the interior of box tubing.

**N. Interior Mirrors/Sunvisors**

**1. Interior Mirror**

Interior mirror (with adjustable mounting bracket) shall be a 4" by 16" flat mirror glass with rounded corners, minimum. Interior mirror adjustment and location shall allow the driver to view the complete passenger compartment. Location shall be determined at pilot model production. Suggested source: ROSCO model 416 (with bracket), B&R Manufacturing #1716, Manufacturer's standard, or equal.

**2. Sun Visor**

Windshield sun visor system shall be standard OEM chassis visor(s). If the OEM chassis is not equipped with a windshield sun visor, two large transit-type, fully adjustable, double-knuckle, arm-type plexiglass sun visors shall be provided for the driver at the windshield, and at the side window. Location shall be determined at pilot model production. Suggested source: manufacturer's standard.

**O. Exterior Mirrors**

1. Each bus shall be equipped with exterior left-hand and right-hand rear view mirrors of flat glass with convex mirrors (3" in diameter, minimum) attached or a combination flat/convex glass. The mirror shall contain at least 70 square inches of flat glass viewing area. Suggested source: RAMCO 700FF, B&R Manufacturing, Metagal, or equal.
2. To prevent obstructed front and right-hand view a convex 15 degree radius (curvature) exterior crossview mirror (8" minimum diameter) shall be provided on the left-hand (driver's side) front corner of the bus. Suggested source: Manufacturer's standard.
3. All exterior mirrors shall be constructed with high impact plastic or stainless steel housings.
4. Mirror mountings shall be reinforced or use Well-Nut or equal when not in a structural frame member, with approval by the State at the time of pilot model production. The mirror placement shall not obstruct driver vision nor have window divider bars between the driver and mirror face. Final location of exterior mirrors shall be determined at pilot model production.

**P. Seats**

**1. Driver's Air Suspension Seat**

- a. The driver's seat shall be a air suspension seat with mounting base (riser), headrest, and armrests. The seat shall comfortably hold and support the human body in the orthopedically correct position for driving. It shall be adjustable so that persons ranging in size from the 5th percentile female to the 95th-percentile male may be accommodated to operate the coach. The solid bar stock scissors style 12" minimum exterior width suspension system shall have two dampeners that resist force in both directions, be rubber bumper cushioned at the bottoming out point, and be mounted above the fore and aft slide. The scissors style air suspension driver's seat shall have adjustments for: 1) vertical height, 4" minimum travel; 2) fore and aft slide, 8" minimum travel; 3) back recline, from 60° to 110° minimum: seat tilt, 8 degrees minimum at any seat height; and 4) weight range for people up to 300 pounds. While seated, the driver shall be able to make all of these adjustments by hand without complexity, excessive effort, or being pinched. Manually operated adjustment mechanisms shall hold the adjustments and shall not be subject to inadvertent changes and have latches and operating controls on both sides of the seat. The seat shall be high-backed with headrest and shall have 3 air adjustable lumbar supports and adjustable side bolsters in the region of the back frame. Individual switches shall control the air supply for the lumbar adjustments and the air supply shall be from the vehicle's engine air compressor or from the seat's own external electric air compressor system. A check valve shall be installed to prevent loss of air from the weight control bladder when there is a loss of air supply to the seat. The seat shall have a dust

seal (bellows) to enclose the mechanism and seat mounting base. The seat and the seat mounting base shall be properly aligned behind the steering wheel for maximum adjustments and driver comfort. No part of the vehicle directly behind the seat shall interfere with the seat back for a recline of 15° when the seat is positioned furthest from the steering wheel. FMVSS Certified seat belt with integrated shoulder harness with automatic retractor shall be attached to seat frame as an integral part of the seat unit. All seats and seat mountings shall meet applicable federal standards. Suggested source: USSC Model 9100ALX3, or equal with headrest and armrests.

- b. The driver's seat cushion shall be molded high resilient (HR) polyurethane foam padding with indentation load deflection (ILD) 35 pounds minimum, and the back cushion shall be molded or fabricated high resilient (HR) polyurethane foam padding (ILD) 25 pounds minimum. There shall be no welt or bead across the front of the seat cushion under the driver's legs. Compressions to 10 percent maximum and tensile strength, 15 lbs. per square inch minimum. Seat and back cushion foam shall meet the typical physical properties of ASTM D-3574 and the flammability requirements of FMVSS 302.
- c. The driver's seat covering shall be gray Cloth-type Woven Fabric (with flame retardant qualities) meeting the requirements listed below in Part 4. All Seats.

## **2. Passenger Seats**

- a. All passenger seats shall be available with cloth-type woven fabric covering or vinyl fabric covering and are required to meet the following:
  - (1) Complete White Book tests
  - (2) All applicable FMVSS testing including FMVSS 210
  - (3) Comply with cloth-type woven and vinyl fabric seat covering material test and performance criteria of the Federal Register dated October 20, 1993 (see Section IX., table 1).
- b. Two passenger, forward facing seats shall be 35" minimum width with back mounted energy absorbent grab handles on each seat back (two per double seat) that is not against a wall.
- c. Single passenger seats shall be 17½" minimum width with back mounted energy absorbent grab handle except when against a wall.
- d. Forward facing seats shall have 26½" minimum knee to hip room.
- e. Aisle facing seats shall have arm rests on both ends if the seat is not against modesty panel.
- f. Aisles shall not be less than 16" wide except as noted in Part 3 of this section.

- g. Suggested sources: CE White Co. L Series, Freedman Feather Weight, or equal.

### **3. Wheelchair Lift-Equipped Buses**

Forward facing (double) fold-away seats with seat belts shall be provided in the wheelchair securement area per seating arrangements (see Section III, Wheelchair Securement Area). Fold-away seats shall include all dimensional, structural and testing requirements of the standard seat specification. Seat locking/latching devices shall be of high quality and be easy to latch and unlatch. Seats must positively latch in the seated and folded position to prevent inadvertent folding or unfolding of the seat. Any support legs resting on flooring shall be non-marring or rest on metal plates flush mounted with flooring. All fold-away seats shall be able to pass FMVSS 210 without having to fasten additional latches or cables. All fold-away seats shall fold against the wall when wheelchair space is required (no further than 12" from wall in the vertical folded position). Seat may extend into bus approximately 37¼" (two passenger) and 18½" (1 passenger) when folded down for passenger seating. Aisle space may be reduced to 14" inches where fold-up seating is placed on each side of the aisle or 15½" where placed opposite a stationary seat. The seat bottom cushion shall be a 5 degree tilt up from level, minimum, and back cushion shall be at 95 degrees, minimum. The seats shall be of the same design as the other passenger seats. All seat backs of fold-away/fold-up seats shall be covered with material matching seat cushion color and material. All seat bottoms shall be covered with a flame blocker material between seat spring and seat cushion. Suggested source: CE White Co. L-Series; Freedman Feather Weight, Braun #125, or equal.

### **4. All Seats**

Seat cushions and backs shall be individually contoured to each passenger for occupant comfort and retention. Seats shall be covered with cloth-type woven fabric or vinyl fabric at transit agency's option. All seat backs shall be covered with material matching seat cushion color and material. All seat bottoms shall be covered with a flame retardant material between the seat spring and the seat cushion. All seat covering materials shall comply with test and performance criteria of the Federal Register dated October 20, 1993 (see Section IX., table 1). Seat covering materials shall be solid color with a multi-colored center insert approved by the State.

#### **a. Cloth-type Woven Fabric Requirements** (With flame resistant qualities)

- (1) Minimum weight 23 ounces per linear yard.
- (2) 50,000 minimum double rubs (ASTM - 3597-77 Wyzewbeek Method).
- (3) Color fastness to light 300 hours minimum (AATCC-16-1977 Carbon Arc.)

- (4) Comply with cloth-type woven fabric seat material test and performance criteria of the Federal Register dated October 20, 1993 (see Section IX., table 1).
- (5) Comply with California BLT-117.
- (6) All Cloth-type woven fabrics except Holdsworth wool shall be treated with a flame proofing solution following the manufacturer's specifications, No-Flame by Amalgamated Chemical Inc., or equal.
- (7) Suggested source: Flame Resistant Fabrics by Kings Plush, Holdsworth Wool, or equal.

**b. Vinyl Fabric**

- (1) Seat vinyl fabric shall be transportation grade expanded vinyl, 36 ounces per linear yard minimum.
- (2) Seat vinyl fabric shall comply with test and performance criteria of the Federal Register dated October 20, 1993 (see Section IX., table 1).
- (3) Vinyl-coated fabric shall meet the requirements of Federal Specification CCC-A-680a Class II, treatment A1.
- (4) Suggested source: Flame Resistant vinyl by GenCorp Polymer Products or equal.

**c. Seats General**

- (1) Seat cushion and back cushion shall be fabricated high resilient (HR) polyurethane foam padding. Seat cushion indentation load deflection (ILD) 35 pounds minimum, with compression to 15 percent maximum, and tensile-strength of 15 minimum. Seat and back cushion shall meet the physical properties of ASTM D-3574 and the flammability requirements of FMVSS 302, minimum. The technical data sheet for the foam supplied shall be included in the bid proposal with the seat information. Suggested source: Manufacturer's standard.
- (2) The seating arrangements and configuration shall be furnished by the State.
- (3) All seats shall be supported on the floor with high carbon steel T-type support brackets with a powder coat epoxy paint finish. Floor anchorage shall be neat and not interfere with entering and exiting the seat. All seat mounting bolts shall be a bright finish corrosion resistant coated/plated fastener. All seats and seat mountings shall meet all applicable FMVSS including FMVSS 207, 208, 209, and 210.

- (4) Seat frame shall be cold-roll steel tubing. The frame shall have a powder coat epoxy paint finish.
- (5) Seat and back cushions shall be supported with a spring-type support system. Seat and back cushions shall be completely covered with covering material. Seat back depth shall not exceed 3½" overall.
- (6) All metal components of the seat assembly shall be coated with a powder coat epoxy paint finish that shall meet the following tests:
 

Salt Spray	1000 hrs	ASTM D117
Humidity Resistance	1000 hrs	ASTM D2247
Impact Resistance	to 80 in-lbs	ASTM D2794

All testing is to be performed on standard seating metal materials that have coating thickness of 1.3 to 1.8 mils. Certified test documents are required with bid proposal.

## 5. **Passenger Seat Belts**

The successful bidder shall provide certification test data that the seats, the seat belts, and the installation are in compliance with FMVSS-207, 208, 209, and 210 where applicable (see Section VIII. L.).

Three universal "Buckle Up" decals approximately 6" by 6" shall be furnished loose with each bus. Decals shall indicate the belt use is suggested only.

All seats shall be equipped with seat belts for each designated seating position. Belts shall have:

- a. An emergency locking retractor secured to the seat frame or bus structure. The retractor shall be part of the latch end of the belt. Final locations shall be determined at pilot model production.
- b. A push button latch release mechanism.

## Q. **Handrails, Stanchions (Shall meet ADA regulations)**

- 1. The handrails and stanchions shall be a minimum of 1¼" outside diameter. All handrails and stanchions shall be positioned so as not to interfere with wheelchair movement and shall meet ADA requirements for position and size. All handrails and stanchions in the passenger entrance area shall be highly visible yellow in color. All other handrails and stanchions shall be brushed stainless steel. Mounting brackets and fittings shall be composed of the same kind of material used for the stanchion or handrail.
- 2. All handrail and stanchion mountings shall have reinforcement plates welded to or imbedded in the structure behind surface panels of sufficient strength to withstand passenger force. Final locations shall be determined at pilot model production.



3. A floor-to-ceiling vertical stanchion shall be provided in close proximity to the rear of the driver's area near the aisle. A guardrail shall be provided in back of the driver's area extending from that vertical stanchion to the left (driver's) side of the coach 30" ( $\pm 2$ ") above the floor or may attach to a second vertical stanchion positioned close to the wall. A padded modesty panel shall be provided from the guardrail to within 8" of the floor. The stanchion and guardrail shall not impair driver's seat adjustment. Aisle side vertical stanchion may be used for farebox mounting.
4. A smoked plexiglass panel, 3/8" thick, shall be provided behind driver from top of driver's seat to within 12" of bus ceiling. The panel shall not impair driver's seat adjustments. The panel may be incorporated into the stanchion and guardrail behind the driver but must provide for a handhold area on the vertical stanchion.
5. Floor-to-ceiling stanchions (yellow) shall be provided near aisle on each side of front entrance. Front passenger entrance forward side stanchion may be used for farebox mounting.
6. Left and right side entrance handrails (yellow) shall be installed from low stepwell to floor-to-ceiling stanchions near aisle. Entrance handrails shall be positioned so passengers entering or exiting the vehicle will have handrail support throughout the entering/exiting process and so that articles of clothing may not become entangled in the handrail-stanchion-guardrail assemblies.
7. A guardrail (brushed stainless) shall be provided at the left (rear side) of the front entrance steps, extending from the vertical stanchion to the right side of the coach 30" ( $\pm 2$ ") above the floor. A modesty panel (padded both sides, vinyl clad) shall be provided to the left (rear side) of the entrance from guardrail to floor (in case of lift vehicle, provide floor-to-ceiling stanchion with guardrail and modesty panel to rear of platform lift).

**R. Interior Lighting**

1. One overhead entrance light together with stepwell lights shall provide no less than two foot-candles of illumination on the entrance step tread, or lift or ramp with the door open. Outside light(s) shall provide at least 1 foot-candle of illumination on the street surface within 3 feet of step tread outer edge. This system shall provide illumination automatically when the door is open and meet ADA requirements.
2. Overhead entrance and stepwell lights shall be wired to and be automatically activated by a door controlled switch. This circuit shall be on with the key in the run or accessories position.
3. Stepwell light shall be on side away from wheel splash.
4. Interior lighting shall provide a minimum of two foot-candles of illumination at a reading level. Interior lighting fixtures shall be reasonably flush with the interior walls and ceiling so no hazard

exists for the passengers. All lights shall have lead wire long enough to remove light at least 6" from vehicle for service. All interior lights shall be grounded by an in-harness ground attached in the fuse panel to a common grounding point.

5. Lift platform light installation shall be designed to illuminate the platform when deployed at floor level at no less than two foot-candles of illumination. Outside light(s) shall provide at least 1 foot-candle of illumination on the street surface within 3 feet of step tread outer edge. This system shall provide illumination automatically when the lift door is open and meet ADA requirements. Light switch shall be door-actuated on-off.

**S. Exterior Lighting**

1. Exterior lighting shall be in accordance with Federal Motor Carrier Safety Regulations (393.11) and ADA regulations. All lights shall have lead wire long enough to remove light at least 6" from vehicle for service.
2. Exterior marker lights shall be 2" diameter flush style sealed lamp retained in a rubber grommet mounting and conform to Federal Motor Carrier Safety Regulations Part 393 (Peterson lamp, Trucklite or equal). All marker lights shall have a weather proof two prong (one positive and one ground) plug-style connector with the ground wire connected to an in-harness ground attached in the fuse panel to a common grounding point. Marker lights shall be operated through a relay controlled by the headlight switch.
3. One red sealed, voltage regulated LED high mount stop lamp shall be mounted centrally in the rear panel of the bus and work in conjunction with the brake lights. On buses with a rear emergency exit door, the voltage regulated LED red 6½"x2¼" oval light shall be mounted between the upper and lower windows on the exit door. On buses with a rear emergency exit window, the voltage regulated LED red 4" round light shall be mounted on the rear of the bus body just below the rear emergency exit window. Final location of high mount stop lamp shall be determined at pilot model production.
4. All exterior lights shall be grounded by an in-harness ground attached in the fuse panel to a common grounding point. All exterior lights of the bus shall be sealed lamps properly mounted except for headlamps. Headlights shall be Halogen lamps and the front park/turn lights may be a part of the headlight assembly.
5. All lights shall be sealed from moisture with sockets mounted to top where possible and the mounting to body shall be sealed. All lights in the rear panel of the bus shall be flush style round sealed lamps (by Peterson, Truck-Lite or equal) retained in a rubber grommet mounting except the license plate lamp.
6. Brake lights shall be red 4" round sealed voltage regulated LED lamps and shall not override hazard flashers or turn signals. Rear turn

signal lamps shall be amber 4" round sealed voltage regulated LED lamps.

7. Hazard flashers shall be equipped with a heavy duty dash mounted control switch with indicator (audible and green light) and heavy duty transistorized flasher. The control pull/push knob shall be within easy reach of the driver and the indicator light shall be in clear view of the driver. Final location of hazard flasher control and indicator shall be determined at pilot model production. Suggested sources: Hela, Signal Stat or equal.

**T. Safety Equipment**

All safety equipment provided by the manufacturer shall be secured to each vehicle and be easily accessible to the driver. Location of safety equipment shall be determined at pilot model production. The safety equipment shall be:

1. One UL listed 5 pound, 2A-10BC dry chemical fire extinguisher. Fire extinguisher shall have a metal head, a gauge to indicate state of charge, and a bracket with strap for mounting and securement. Source: Manufacturer's Standard.
2. One container of bi-directional emergency reflective triangles that meets FMVSS 125.

**U. Heating/Ventilating/Air Conditioning (HVAC)**

1. During normal passenger service, including service for people with disabilities, front and rear heavy-duty heating system shall be capable of raising the interior temperature of a bus from 0°F to 60°F at knee level (22" above the floor) throughout the interior of bus within 30 minutes from engine startup. After initial warm-up while the bus is in passenger service, the front and rear heavy-duty heating system shall be sufficient to maintain a minimum of 64°F at knee level throughout interior of bus and at the driver's foot space when the outside temperature is 0°F. Heating system operation will be verified by the required system testing as defined in Section VII Part D. Heating/Ventilating (HV) Certification. In addition to the front heater and windshield defrosters, one 6" two speed fan with non-glare blades and body shall be mounted in the driver's area for increased air circulation. Grounding for all heater fan motors shall be supplied by an in harness ground wire attached in the fuse panel to a common grounding point. All HVAC fan motors shall be supplied with proper radio frequency (RF) suppression equipment to remove two-way radio interference.
2. Front heating unit shall be automotive in-dash type (chassis OEM or equal) and shall be capable of delivering heat, fresh air ventilation, and air conditioning (optional) to the driver's area. The front heater shall have a temperature control valve which can be regulated from the driver's area. The driver's area shall have air circulation in each mode of defrost, heat, fresh air ventilation, and air

conditioning (optional) of 125 cfm at the foot area, with a total driver's area circulation of 400 cfm minimum.

3. Rear heating unit(s) shall distribute heated air in at least a 180° direction. Heating unit(s) shall be placed to maximize interior air circulation and minimize forcing heat out of opened doorways. Heating unit(s) shall have a minimum ¾" inside diameter (ID) coolant inlet and outlet with a BTU/hr output needed to meet specified HV performance requirements. Coolant flow through the heating units shall be maintained at low engine speed to ensure adequate heat output of the heating unit. Coolant flow through the heating units shall not be restricted by excessive bends or kinks in hoses or excessive lengths of hoses. Heating units shall have rubber or nylon insulator(s) between their mounting base and floor of the bus. Suggested sources: Bergstrom, A. R. Lintern, AMFAB Inc., or equal.
4. The entrance stepwell shall include a 12 volt electric heating element/unit for the lower step to prevent icing of entrance steps. The low voltage step heater shall consist of one or more wire elements laminated and vulcanized between two plies of .026" silicone rubber impregnated fiberglass cloth to maintain an approximate temperature of 160° F with a low temperature (30° F) sensing switch (Warm Welcome® by Lighthouse International, Ltd., or equal). The entire lower step heating unit with power wires shall be enclosed between the stepwell and the step tread (beneath the step tread) of the lower step. Lead wires shall be loomed, supported by brackets, and protected by grommets where they pass through structure. The temperature sensing switch shall be located in a protected area under the bus in the stepwell area.
5. The premium heater hose (¾" ID minimum) shall be high temperature resistant Ethylene Propylene Diene Monomer (EPDM) material. Hose shall be a reinforced type with Aramid knitted fiber reinforcement between the EPDM tube and EPDM cover. Heater hose material shall be compatible with all types of coolant including long life coolant. Rated temperature limits of the hose shall be -40°F to +300°F minimum with a burst pressure of 130 PSI minimum.
6. Manual shut off valves for the rear heater shall be placed in the heater outlet line (from engine) and in the heater inlet line (to engine) and be as close to the engine as is practical. Shut off valves shall be accessible by service personnel through an access door or otherwise positioned for access without going under the bus. The heavy-duty brass ¼ turn ball valves shall have ¾" ID, minimum. Location to be determined at pilot model production.
7. All heat lines and hoses shall: have interior routing where possible; be sufficiently protected to ensure against wear from friction and the elements; be insulated to reduce heat loss when exterior routing is used; use routing that eliminates excessive bends and hose lengths; and have heater hose passage holes through engine cowl and floor area thoroughly sealed to prevent air, dust, and moisture intrusion.
8. Air Conditioning (see Alternate Quotes, Section VI. A).

## V. Windows

1. Windows shall be top T-type slider, full slider, or top tip-in type for window ventilation. Windows shall have double-density safety glass and heavy-duty locking features which shall meet FMVSS 217 for emergency exits, if applicable. Window glazing material shall be able to maintain its seal and glass retention for the life of the unit. Caulking around windows shall be used only as a seal, not to make up for body defects or out of tolerance window openings (maximum clearance of C" around retention frame, 1/16" on each side). All window glass shall be tinted (passenger windows AS-3 tint, windshield one solid tint or shaded-tinted) and meet applicable federal standards. Driver's compartment right and left side windows shall be designed for maximum window area to provide unobstructed vision. Driver's compartment left side window shall be adjustable vent type (moveable front section of lower portion for ventilation) or chassis OEM door window. Driver's right side window shall be one piece. Suggested sources: Hehr, International, Inc., Kinro, or equal.

## W. Paint

1. All exterior surfaces shall be smooth and free of visible fasteners (excluding round head structural rivets), dents, and wrinkles. As appropriate for the paint used and prior to application of paint, the exterior surfaces to be painted shall be properly cleaned and primed to assure a proper bond between the substrate and successive coats of original paint. Paint shall be applied smoothly and evenly at 6 mil thickness with the finished surface free of dirt, runs, orange peel, and other imperfections. All exterior finished surfaces shall be impervious to diesel fuel, gasoline, and commercial cleaning agents. Finished surfaces shall not be damaged by controlled applications of commonly used graffiti-removing chemicals.
2. All exterior paint shall be a two part low volatile organic compound (VOC) emitting acrylic-urethane-type or polyurethane-type. The finish coat of paint shall be applied before rubrail covers or inserts, fender flares, exterior lights, and other body mounted accessories are installed. Paint shall be applied in the following method:
  - a. If on bare aluminum, use proper cleaner. Recommended sources: DuPont 2253, PPG, or equal followed by aluminum conversion. Recommend sources: DuPont 2265, PPG, or equal.
  - b. If on bare steel, use proper cleaner. Recommended sources: DuPont 5717S, PPG, or equal followed with steel conversion.
  - c. For all bare metal, use primer. Recommended sources: DuPont Prime 615/616 (two coats), PPG, or equal.
  - d. No primer required on fiberglass surface.
  - e. Coat entire prepared surface to be painted with minimum of two coats of paint properly activated and reduced. Recommended sources: DuPont Imron, PPG Concept System, or equal.

3. Vehicle paint schemes of two colors (full color plus 11" wide belt stripe) is standard and will be required when requested by the agency. Color scheme on all vehicles shall be provided at the time of ordering. A single color (no stripe) full paint scheme will be quoted as an option (deduct). An additional single color 11" wide belt stripe (second stripe only) or a roof painted a different color will be quoted as an option.

**X. Insulation**

1. Inside walls, ceiling, passenger floor area, driver floor area, and fire wall area shall be adequately insulated for sub-zero winters with spray-type foam insulation or glued in place insulation with a minimum R factor of 5. The insulation shall be non-formaldehyde, fire-resistant (FMVSS 302 minimum), non-hygroscopic, and resistant to fungus. Insulation shall prevent condensation and thoroughly seal bus so that drafts cannot be felt by the driver or passengers during normal operations with the passenger door closed. Insulation shall not cover up electrical wiring harnesses, electrical switches, or other devices and shall not be sprayed in wheelwells. All mechanisms (moving or stationary parts) that are affected, create a fire hazard, or are rendered useless by an application of sealant or insulation shall be cleaned free of sealant or insulation, including vent canisters and drain pipes.
2. Engine hood cover and driver's area shall have adequate insulation to keep driver's foot area cool during summer months, warm during winter months, and reduce engine noise to the specified level.

**Y. Type I Lift, Active (Platform) (Meet ADA Requirements)**

1. The Type I platform lift (active lift) shall be installed in a separate door opening for use by persons with disabilities. The lift assembly shall be mounted within the bus body on the right (curb) side. The overhead clearance between the top of the door opening and the raised lift platform, or highest point of a ramp shall be a minimum of 68" for a bus over 22 feet in length to meet ADA requirements.
2. The lift door(s) shall be manually operated with an outside key locking handle. Gas struts or manual latches shall be provided for the lift door(s) to positively hold the door(s) in the open position. All door openings shall have full structural framing around the opening equal to the structural members of the body. The lift door(s) shall have an upper window similar to the side windows of the bus.
3. The lift shall be an electro-hydraulic type. The lift shall not have a crossbar above the door opening. The platform lift equipment shall be a double "C" channel parallel arm construction, hydraulically operated by two single-acting cylinders with gravity unfold, gravity down, power up, and power fold (stow) operation. No part of the lift platform shall exceed 6 inches/second during lowering and lifting an occupant, and shall not exceed 12 inches/second during deploying or stowing. The lift shall have a mechanical outboard safety wheel stop

to prevent wheelchair from rolling off the platform during the lifting cycle. Successful bidder shall deliver the lift equipped bus with the type of lift equipment requested by the State. Suggested sources: Braun, Ricon, or equal.

4. A manual safety override shall be provided. Lift shall have manual override instructions visible from inside and outside the bus with door open.
5. The entire lift assembly shall be installed inside the bus body and shall have adequate protection installed on all sharp corners or items that protrude into the passenger area to prevent accidental injury to passengers. Wall and floor mounting points shall be reinforced and shall be attached with fasteners having a thread locking feature. Lift installation shall insure that no lift rattling exists when the vehicle is operated while the lift is stowed.
6. A lift control interlock system shall be installed that shall ensure that the vehicle cannot be moved when the lift is not stowed and that the lift cannot be deployed unless the interlock is engaged [to meet ADA regulation in 49 CFR Part 38, Subpart B--Buses, Vans and Systems, §38.23, (b)(2)(i)]. The interlock system shall engage when the lift operation sequence is followed. Interlock operating instructions shall be included with the bus at delivery. An indicator light (red, labeled) shall be provided at the driver's station that is activated when the lift door is open and when the lift is in operation.
7. The lift color shall be match interior tones of the vehicle approved by the State.
8. Lift vehicle shall display international symbol of accessibility, one each on left and right side of vehicle. Location shall be determined at pilot model production.
9. The active lift shall meet ADA requirements as well as these minimum requirements.
  - a. Capacity 600 pounds minimum.
  - b. Usable platform width 32" minimum.
  - c. Usable platform length 48" minimum.
  - d. Platform shall include automatic locking inboard safety wheel stop (minimum 6" height) from rolling off.
  - e. Platform shall automatically stop at floor level.
  - f. Platform shall automatically stop when lowered to ground level.
  - g. Controls shall be conveniently located on a flexible, cut resistant cable and shall be mounted with access from inside or outside the vehicle.

- h. Platform, bridge plate, and area between bridge plate and aisle shall be skid resistant.
- I. Bridge plate and platform shall be coated to resist rust.
- j. Platform shall have horizontal handrails (one each side) on platform to assist passenger during lift operations. Handrails shall fold automatically to prevent any obstructions into the vehicle passenger area.
- k. Lift door operated interrupt switch shall prevent use of lift with lift door(s) closed. Heavy duty long life switches shall be used in this application.
- l. The color of the lift shall coordinate with bus interior colors.
- m. Sharp corners of lift platform shall be padded when in stored position (removable padding may be used).
- n. The wheelchair lift shall comply with all federal, Americans with Disabilities Act (ADA), and Veterans' Administration regulations.
- o. Lift operation shall be designed to prevent the platform from touching or leaning against door after being returned to stored position while the lift assembly is not in use.

### **III. WHEELCHAIR SECUREMENT AREA**

- A. The wheelchair securement system shall be installed according to ADA requirements. Securement location shall be installed as shown by seating plan option and approved at pilot model production. Fold-away seating shall be provided for use when wheelchairs are not being carried as shown in floor plans. The integrated securement system shall restrain the occupant and the wheelchair separately and securely.
- B. Wheelchair securement shall meet the following minimum requirements.
  - 1. Forward facing wheelchair tie down and occupant restraint shall consist of four floor attach points for the chair and a lap belt/shoulder restraint for the occupant, per location.
  - 2. Securement floor anchorage points shall be stainless steel or other noncorrosive metal construction and consist of aircraft type insert pockets that can be flush mounted with the rubber flooring ("L" style track). Floor anchorage points for one securement space shall be spaced at a minimum of 54" from front to rear. Floor anchorage points shall be located no closer than 8" from a stationary wall or obstruction (forward or rearward) that would hinder an operator from attaching the securement system. Anchorage points can be used for the front tie downs, the rear tie downs, or can be shared by both.
  - 3. Securement wall anchorage point for shoulder restraint shall be stainless steel or other noncorrosive metal construction. Wall



anchorage device shall provide vertical adjustment for differences in height of the secured mobility aid and user. Wall anchor shall be fastened to body structure in the wall according to the manufacturer's installation instructions.

4. The belt components shall be easily identified as to their location of use as follows: "front", "rear", "lap", or "shoulder". The four belts that attach to the wheelchair from the floor anchorage points shall use a simple speed hook end for chair attachment and have automatic heavy duty retractors with a hard bright metal cover and dual knob control. All floor attachment belts shall be the same and work in any of the four attachment points and be equipped with connector brackets for the lap/shoulder belt assembly. Automatic self tensioning and self locking retractors with metal covers shall be part of the belt assemblies for automatic belt tensioning.
5. All belt components shall meet ADA requirements and random static testing forces equal to:

rear belt assy.	6,000 lbs. each, minimum
front belt assy.	2,000 lbs. each, minimum
lap belt assy.	2,500 lbs. each, minimum
shoulder belt assy.	2,500 lbs. each, minimum
floor insert assy.	6,000 lbs. each, minimum
6. All components shall be able to meet ADA requirements.
7. Suggested sources: American Seating Advanced Restraint Module, Q'Straint Model QRT™ Q-8100-A1 Deluxe Retractor System with scooter pocket, or equal.

- C. Containers shall be provided for wheelchair restraints so that the restraints can be stored in the bus when not in use. Location of storage container will be determined at pilot model production.

#### IV. CHASSIS SPECIFICATIONS

The chassis shall have a pre-delivery inspection performed by a representative of the chassis manufacturer before the bus manufacturing process begins. A copy of the completed pre-delivery inspection form shall accompany the bare chassis and accompany the vehicle during manufacture as part of the build order. All standard or optional chassis equipment to be included shall be as advertised by the manufacturer and factory installed and shall not consist of substitute or after market equipment. Optional chassis equipment not available from the factory may be dealer installed. The chassis shall meet the following minimum requirements.

##### A. Chassis

Chassis shall be heaviest available for wheelbase, designed for transit use with straight channel side rails of 50,000 pounds per square inch (PSI) minimum yield strength steel. Chassis shall have one front axle (I-beam) and one rear axle (full floating). Front axle shall have kingpins with adjustable tapered roller bearings (upper) and front axle shall be mounted for sharp steering angle (minimum lock angle of 48°). **Note:** Axles (front

and rear) shall be equipped with axle oil seals (Stemco, Chicago Rawhide, or equal), shall be filled with 75W-90 synthetic oil, and front hubs shall include fill plugs and fluid level windows.

**B. Tilt Wheel/Power Steering**

Chassis shall be equipped with power steering and a tilt wheel steering column, minimum.

**C. Wheelbase**

The desired wheelbase range shall be 126" to 217".

**D. Engine, Diesel**

1. The electronically controlled engine shall be either an in-line 6 cylinder turbocharged diesel engine 5.9l minimum, 190 gross horse power at 2,600 revolutions per minute (RPM) with air-to-air after cooling or an 8 cylinder (V-8 OHV) turbocharged diesel engine 6.5l minimum, 190 gross horse power at 2300/2600 RPM with air-to-air intercooling. Acceptable engines include Caterpillar 3126, Cummings 5.9 ISB, and Navistar International Transportation Corp. T 444E, or equal. The diesel engine shall be equipped with a fuel/water separator unit with a dash indicator light and an automatic engine shutdown system (see Section V., part A., Item 6). The electronic diesel engine shall meet current EPA emissions standards for buses. Materials for cylinder head and valves and other internal engine parts shall be compatible for alternate fuels use when alternate fueled vehicles are requested (see Section VI. H. and K.). Driver's area noise level (at driver ear level) shall not exceed 82 DBA at a constant speed of 55 mph on a level roadway and shall be verified at pilot model production.

2. Auxiliary Coolant Heater

a) All vehicles with diesel engines shall be equipped with an auxiliary heater system that shall be able to preheat, provide supplemental heat, and maintain heat for the engine and the interior of the bus. The auxiliary heater system shall be supplied in heated coolant model for diesel engines. The heater system shall be complete with all fuel and electrical controls, exhaust system, and standard warranty. All auxiliary heaters shall be 12 volt units with a fused power supply and with protection for high and low voltage conditions. The auxiliary heater system shall meet FMVSS 301 fuel system integrity requirements. The heating units shall be fueled from the vehicle's primary fuel supply. The on/off seven day programmable modular electronic timer controls for the heating units shall be located in the driver's area of each vehicle. The electrical connection shall be a one piece harness from the control switch to the heating unit with all exterior connections Weather-Pak or equal. The auxiliary heater's exhaust system shall be of rigid tubing that extends to the engine exhaust exit point or to the outer edge of the body. Location shall be determined at the Pre-Pilot Model Review Meeting.

- b) The heated coolant model shall be a self-contained unit mounted under the bus near the rear heating unit, and connected to the heater hoses leading to the rear heating unit. The unit shall be complete with mounting brackets/hardware and circulator pump (not boxed). The unit shall be mounted in an enclosure similar to a battery box with a manufacturer's standard exterior access door with hinge and flush pull-style (SouthCo Model #M1-61-1 or equal) latch(es). The door shall be easily accessible for servicing and be weather resistant. The heated coolant system units shall have as safety features temperature regulating and overheat shut down switches and include a seven day timer to control operation. The coolant heater shall control coolant temperature between a low of 154°F and a high of 185°F. Coolant heater output shall operate automatically at different levels with a high heat output of 25,500 BTU/hr minimum (boost setting may be higher). Suggested sources: Espar Inc., Hydronic 10 (diesel, heated coolant), Webasto Thermo 90S (diesel, heated coolant), or equal.

**E. Transmission**

The transmission shall be a heavy-duty, four-speed automatic minimum, with increased cooling capacity to match GVWR of bus. The shift control shall have P, R, N, D, 3, 2, and 1 quadrant positions and automatically engage the parking brake when placed in the "P" position. The transmission shall have an external spin-on type filter. Suggested source: Allison Transmission AT545, minimum, or equal matched to the electronic engine.

**F. Alignment**

The bus shall have a four wheel alignment at final point of inspection, just prior to delivery to transit agency. A copy of the work order indicating the camber, caster and toe-in settings shall be furnished for the final inspection and sent with bus at delivery.

**G. Gross Vehicle Weight Rating (GVWR)**

**I-Beam Front Axle - 8,000-lb. minimum.** Bus weight shall not exceed chassis manufacturer's front axle weight rating or spring and tire capacity.

**Rear Axle - 13,000-lb. minimum.** Bus weight shall not exceed chassis manufacturer's rear axle weight rating or spring and tire capacity.

**Chassis GVWR - 21,000-lb. minimum.** (see Purpose of Specifications Section I.) Engineering calculated loaded vehicle axle weight charts are required with the bid.

**H. Differential**

Heavy-duty rear axle with full floating axles. Gear ratio shall allow loaded vehicles to travel approximately 65 m.p.h. and not exceed manufacturer's recommended operating engine RPM.

## **I. Battery**

The battery equipment shall be furnished by the chassis manufacturer where available. The dual batteries shall be maintenance free with reserve capacity of 400 minutes @ 27° C, CCA-1250, 12-volt minimum (dual Delco Group 31-1150 series or equal). The batteries shall be mounted on a stainless steel pull-out tray (easy sliding) with battery hold down secured with bolts. The pull-out tray shall be mounted on properly supported slides with ball bearing equipped roller supports, all of which shall have adequate capacity to support the battery equipment. The battery tray slide shall allow movement to permit full service of batteries outside of the bus body. The inside of the battery compartment shall be covered with a durable insulating material to prevent electrical shorts. The totally enclosed battery compartment shall be vented and the tray shall be coated with an acid resistant coating. The battery compartment must be located below the floor line with adequate reinforcement brackets mounted to floor supports. The insulated battery compartment door shall be manufacturer's standard with hinge and flush pull-style (SouthCo Model #M1-61-1 or equal) latch(es). Battery cables shall be size 2/0 minimum, fine stranded, flexible copper wire with soldered on cable connector ends with heat shrink insulation applied. Adequate room shall be provided in the battery compartment for cable movement when sliding batteries out for service. Cable assemblies installed in place of chassis manufacturer's battery cables shall be sized to match the electrical system's maximum current draw to provide proper starting and operation of all systems.

## **J. Battery Cables and Grounds**

Battery positive and ground cables shall be AWG size 2/0 minimum, fine stranded, flexible copper wire with permanently affixed cable connector ends with heat shrink tubing applied. All cable ends shall be fastened in a manner equal to the method used by the chassis OEM. Positive cable ends at the battery shall use a protective cover or cap as an added insulator. Cables assemblies installed in place of chassis manufacturer's battery cables (see Battery, Section IV. I.) shall be sized to match the electrical system's maximum current draw to provide proper engine starting and operation of all systems.

A ground of the battery cable size shall be installed between the engine and chassis frame. The vehicle body shall be properly grounded to the chassis frame in at least two places. Engine and body grounds shall be installed to handle subsystem electrical capacity. Grounding wires fastened to the frame shall use a bolt with nut installed in a proper sized hole with dielectric compound applied to the cleaned surfaces, bolt, and cable end. Lift pump motor shall be grounded directly to chassis frame using a cable of the same size as the pump motor feed wire. All exterior lights and accessories added by the body manufacturer shall be grounded by an in-harness ground attached at a fuse panel common grounding point. For all ground wire connections paint shall be removed at the grounding point to provide a cleaned surface. A coating of dielectric material shall be applied to the cleaned surface, cable end, bolt, and nut where each positive or grounding cable is attached.

All vehicles shall be supplied with proper radio frequency (RF) suppression equipment to reduce radio interference and improve radio transmission and reception performance. High corrosion resistance and high conductivity braided ground straps shall be added: between the engine and the chassis frame of 1" width, minimum; between the engine and the firewall of ½" width, minimum; two between the frame and the body sections of ½" width, minimum; and between the separate body sections of ½" width, minimum. For all braided ground wire connections, paint shall be removed and a coating of dielectric material applied to the cleaned surface where each braided cable attaches. All removable covers in the engine area including fiberglass hoods need to be shielded and RF grounded. All braided high corrosion resistance and high conductivity ground straps shall be as short as possible and shall use the negative battery cable attachment point (except those between separate body sections) as the termination point of the RF grounding.

**K. Alternator**

The alternator equipment shall be furnished by the chassis manufacturer where hot output will match system needs. The alternator shall be rated at 160 amps output hot (200°F) at 5,500 rotor RPM, minimum. It shall be a 12-volt dual-belt drive or serpentine belt drive with internal or external voltage regulator. It shall be capable of maintaining the battery at a state of full charge under all operating conditions. The alternator shall be supplied with proper radio frequency (RF) suppression equipment and have a ½" wide braided ground strap connected between the alternator frame and the engine block to reduce two-way radio interference. Any bracket modifications shall not reduce the strength of the mounting bracket. Where chassis alternator equipment is not available, use PennTex PX-319S or equal. Any alternator equipment installed on a vehicle by the body manufacturer shall be covered by a minimum warranty period equal to the chassis OEM warranty. A charging system monitor shall be installed that has visible and audible signals that would detect and warn the operator when the following occur: high charging rate, low charging rate, or battery charge is low. Suggested source: PennTex Industries, Inc. CSM or equal.

**L. Engine Fast Idle**

The engine shall be equipped with fast idle control which includes manual and automatic control features. Fast idle shall not activate unless parking brake is set and transmission control is in neutral (N) or park (P). The control system shall have a manual switch, volt sensor, an indicator light, and activate automatically from voltage sensors. The system shall automatically deactivate when vehicle is shifted into gear and when the vehicle foundation brakes are applied. Suggested source: Vortec MD30-2500, PennTex Model PX-HI-###-### with time out module or equal.

**M. Brakes**

The Antilock Brake System (ABS) foundation brakes shall be a power-actuated hydraulic split system of four wheel disc-type, with four channel anti-lock braking control. Braking system shall be the heaviest-duty available for stop and go operation. The brake system shall include a red brake warning lamp (RBWL) in the instrument cluster that lights when the parking brake is

on, when a front or rear hydraulic failure occurs, or when brake fluid is low in the reservoir.

1. Foundation front brakes -- Minimum 14.75" x 1.34" disc rotor with dust covers with a minimum of 74 square inches pad lining or equal.
2. Foundation rear brakes -- Minimum 14.75" x 1.34" disc rotor with dust covers with a minimum of 74 square inches pad lining or equal.
3. An air or hydraulically operated parking brake (transmission mounted expanding shoe type) shall be heaviest-duty available from the chassis manufacturer. The brake shall automatically engage when the shift control lever is placed in the "P" position.

**N. Fuel Tank**

Fuel tank capacity shall be a minimum of 45 gallons for 25 foot bus and be a minimum of 60 gallons for the 29 foot bus. Fuel fill shall be protected from weather by a flat spring loaded hinged exterior door and have an access 6" wide by 7" high, minimum.

**O. Hazard Flashers**

Hazard flashers shall be equipped with a dash mounted control (pull on/push off, lighted knob) switch with indicator (audible and light) and heavy duty transistorized flasher. Final location shall be determined at pilot model production. Suggested sources: Signal Stat, Hela, or equal.

**P. Shock Absorbers**

Chassis shall have gas filled shock absorbers front and rear, most heavy-duty available from chassis manufacturer.

**Q. Springs/Suspension**

Chassis front axle shall be equipped with a heavy-duty tapered leaf (parabolic) spring suspension.

Chassis rear axle air ride suspension shall be a spring-beam with air spring (Firestone or equal) on each side with a capacity to match the axle weight rating. Rear air suspension shall use original chassis spring hangers, original axle clamp group, original shock absorbers, and suspension stabilizer (where equipped). The air suspension shall have a single height control valve for the rear axle. The air system shall be complete with an engine mounted air compressor, air lines, and reservoir tank(s) with manual spitter and drain valves with pull chains (Berg manual or equal). The air system shall have a heated air dryer with automatic spitter valve (Bendix AD-9 with heater or equal), a dash mounted air pressure gauge, warning light and warning buzzer. Suggested sources: Chassis OEM equipment, Granning AirGlide or equal.

Heavy-duty suspension stabilizers shall be provided for suspension systems as available from Chassis OEM.

**R. Wheels**

Vehicle wheels shall be 19.5" x 6.75" minimum, steel disc, hub piloted type, 8-hole flange nut style. Steel or brass valve stems 1½" in length shall be used on all wheels with elbow extensions on the inside rear dual for access. Stainless steel, steel or brass valve caps with an inner air seal shall be used.

**S. Tires**

All tires shall be low profile, steel radial blackwall, 245/70R19.5 F/12 ply rating minimum (to meet GVWR). Single front tires shall be high miler or all season tubeless; dual rear tires shall be snow tread tubeless. Suggested sources: Michelin XZA, Goodyear Unisteel or equal.

**T. Drive Shaft**

The multi-piece drive shaft shall have guards of sufficient strength and secured to prevent any driveshaft section from striking the floor of the bus or the ground in the event of a tube or universal joint failure. Driveshaft guards, (OEM chassis equipment preferred or may installed by the chassis manufacturer) shall be equal in materials and design to drive shaft guarding installed on a school bus chassis.

**U. Electric Driveline Brake (Retarder)**

The vehicle shall be equipped with a self air-cooled eddy current electric driveline brake (retarder). Main components of the brake shall be electromagnets (brake coils) fixed to the vehicle frame, two vented rotors, and a controller. The brake shall be mounted between the transmission and the rear axle. The brake shall be of sufficient capacity to match the vehicle GVWR. The brake control that energizes the brake coils shall be either electronic or mechanical and be compatible with ABS brakes (retarder deactivates when ABS controls rear wheel rotation). The controller shall be activated by stage switches engaged by brake pedal movement. Suggested sources: Jacobs Driveline Brake™, Telma, or equal.

**V. Wipers/Horn**

Electric wipers shall be two speed, delay style, dual jet washers (electric) with manufacturer's standard arms and blades. Wiper motors shall be mounted for easy access and not interfere with other equipment mounted in the front bulkhead/cowl of the vehicle. Where individual wiper motors are used (one for each side), each shall be supplied by its own fused feed wire. The vehicle shall have two electric horns.

**W. Radiator and Cooling System**

The cooling system shall have an extra cooling capacity radiator, water pump, pulley, and clutch-type fan with coolant recovery system, and a factory installed coolant filter, all heaviest duty as installed by the

chassis manufacturer. Cooling system shall be winterized with 50/50 mixture of permanent antifreeze and distilled water (-35F° protection). Radiator removal instructions and estimated removal time shall be furnished with first bus to each agency. Coolant integrity shall be maintained throughout the manufacturing process to insure that the coolant, including additives, in the delivered vehicle is equal to the coolant installed at the chassis OEM factory.

**X. Fluids**

Fluids shall be checked and filled from inside front hood where application allows. Engine oil fill/check, transmission oil fill/check, and coolant fill/check shall be located for easy access.

**Y. Engine Cover**

The engine cover shall be insulated from engine heat, engine and road noise. Additional equipment added to the engine cover area shall not interfere with removal/installation of the engine cover.

**Z. Exhaust System**

Exhaust shall exit rear of bus with a 90° turn down deflector per Federal Motor Carrier Safety Regulations §393.83. The tail pipe shall end flush with the rear bumper.

**V. OTHER ITEMS**

**A. Safety Items**

The following safety items shall be provided on each vehicle.

1. A 12 volt 97 db sealed solid state electronic warning alarm that is readily audible from outside the vehicle when transmission is in reverse. The alarm shall: be steam cleanable; have passed a 1 million cycle test; and meet SAE J994, OSHA, Bureau of Mines and all State Regulations. The alarm shall be mounted with bolts and properly grounded in a protected location in the rear axle area (location shall be approved by the State). Suggested source: Manufacturer's standard.
2. The rear door shall have an audible alarm at driver area that is energized when the rear door latch handle starts to open and when the rear door is locked with the ignition in the on or accessory position.
3. A lift master switch with light (green) at driver's station.
4. An indicator light (red and labeled) at driver's station that is activated when lift door is open and when the lift is in operation.
5. An interlock system shall be provided to ensure that the vehicle cannot be moved when the lift is not stowed and that the lift cannot be deployed unless the interlock is engaged (to meet ADA regulation). The interlock system shall engage when the lift operation sequence is



followed. Interlock operating instructions shall be included with each bus at delivery.

6. A warning/engine shutdown system which shall be capable of monitoring oil pressure, engine temperature, and engine coolant level and which shall sound an alarm and shut down the engine when:
  - a. Low oil pressure occurs.
  - b. High coolant temperature occurs.
  - c. Low coolant level occurs.

The warning/engine shutdown system shall include an audible alarm (with warning light) and visual indicator lights (oil pressure, temperature, and the like) in the driver's area. The visual indicator lights shall be labeled to define the source of engine shutdown as a system diagnostic aid. The low coolant probe may be installed in the coolant surge tank but not in the coolant overflow/recovery container. Suggested sources: Chassis OEM, Murphy System, or equal.

7. An automatic daytime headlight control system shall be provided. The system shall illuminate the headlights when the ignition switch is on and the headlight switch is off. The system shall activate automatically after engine start up with the headlamp switch off and shall deactivate automatically when the headlamp switch is on or the ignition switch is turned off. Suggested sources: Chassis OEM, See Me System by A&L Systems & Controls, Inc., or equal.
8. A low profile electronic strobe light (white) with a clear lens and branch guard shall be provided (Meteorlite, Peterson, Target Tech Pulsator® 451, Truck-Lite, or equal). The light shall meet SAE J1318 requirements and be mounted centrally on the roof of the vehicle approximately 6 feet forward of the rear of the vehicle. The 12-24 volt light shall have a control switch in the driver's area. The light shall be approximately 4" in height, produce 80 (±10) double flashes per minute, and have a light intensity of 1 million candlepower with a current draw of approximately 1 ampere.

**B. Electrical and Radio Prep**

1. Lift equipped buses shall have a circuit breaker with a manual reset in the lift feed circuit. The circuit breaker shall be installed near the battery in the positive power cable leading to the lift power pack.
2. All cable and wires added by the body manufacturer shall be continuous color coded and numbered. The manufacturer shall furnish complete as built wiring diagrams with integrated body and chassis wiring marked to show the codes used. Mating harnesses and harness connectors shall use matching wiring and coding unless chassis OEM wiring and coding is different from body manufacturer's.
3. The manufacturer shall install a master battery disconnect switch (rotary switch) positioned close to the driver's area for easy access. This switch shall disconnect the battery from the complete electrical

system including the alternator but excluding the passenger entrance door's fused constant power lead and a fused constant power lead for each electronic control unit's long term memory. Final location shall be determined at pilot model production.

4. Electrical panels installed by the body builders shall be located for easy access. Circuit breaker circuit protection shall be standard but spade type fuses may be used when expressly required by the component manufacturer. The master electrical panel shall use a separate screw-type terminal system. Highest quality components available shall be used. Two spare electrical fuses that match fuses used on the bus body and chassis shall be supplied with the bus and stored in a box or spare circuit area at fuse box.
5. All wiring added to chassis fuse block shall be securely fastened to prevent wires from being knocked loose or loosening from vibration and use wire raceways where needed. Wiring shall be supported at regular intervals by "P" clamps, by other supporting hangers where necessary, and routed in separate hangers from heater hoses or air conditioning hoses. Body fuse/electrical panel shall be sufficiently sealed to prevent intrusion of dirt and moisture.
6. All wiring shall be heavy-duty; be properly grounded to body frame structure and the chassis; use a common grounding point; and be adequate for electrical system capacity. All wiring passage holes through engine cowl, floor area, and other partitions shall be thoroughly sealed to prevent dust and moisture intrusion.
7. All accessories and accessory electrical equipment shall be wired through a constant solenoid energized when the vehicle's ignition switch is in "ignition on" or "run" mode. A master switch with light in the driver's control panel shall control this constant solenoid and act as a quiet switch overriding individual switches for accessories. This master switch is wired in series with the ignition switch to control the constant solenoid. The constant solenoid shall not control headlights, taillights, emergency lights, charging system voltage regulator energizer lead, a fused power lead for the passenger door, and a fused constant power lead for all electronic control units' long term memory.
8. All control switches, relays, and circuit breakers used for the various electrical circuits shall have a current carrying capacity adequate for the circuit that they control and shall be properly marked for their function. The illuminated switch markings shall be permanent and not wear off with switch use. Control switches shall be positioned for easy access.
9. All added wiring shall be installed in a properly sized and supported split open-type loom or a properly supported raceway for protection. All wiring harnesses shall have adequate length to allow for harness flexing from supporting brackets where harnesses connect to electrical equipment. Any wiring added by splicing into an existing chassis OEM harness or wire shall match modification standards set forth by the chassis manufacturer such as Ford's QVM. Any added accessories or

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electrical circuits shall not interfere with nor back-feed into other electrical circuits.

10. Wiring added from OEM chassis wiring to rear lights, gas tank, and/or other accessories shall be supported and protected from ice and snow build-up. Wiring shall be inside bus where possible. Wiring to taillights and other exterior lights shall be long enough to remove assembly by 6" for service. Exterior connections shall be weatherproof positive lock connectors coated with dielectric grease (Weather-Pak, Metri-pak or equal).
11. Scotch lock wire connectors or crimp style butt connectors are not acceptable and shall not be used for wiring installation. Terminals shall be as follows:
  - a. Machine crimped on wire ends shall be used on all harnesses and cable assemblies used in the production of buses. Harness assemblies shall have connectors matching a mating connector where harnesses attach to other harnesses, switches, or other electrical units. When connections are made in any harness assembly where machine applied connectors cannot be used, connectors shall be soldered and covered with heat shrink tubing. In-line fuse assemblies shall use spade type fuses in a Weather-Pak or equal holder and located for ease of service.
  - b. All exterior wiring connectors (plug-ins) including harnesses shall be weatherproof positive lock with the connector pins applied with the proper crimping tool (Weather-Pak, Metri-Pak or equal). All exterior ground connections, except factory supplied braided ground straps, shall have soldered on terminal ends with heat shrink insulation applied.
12. **Two-Way Radio Antenna/Power** - All material and labor required for a pre-installation package for two-way radio equipment shall be furnished by the manufacturer. All equipment and accessories installed as part of the vehicles shall have no measurable radio frequency (RF) interference. All equipment installed on the vehicle must operate in its normal mode while radio transmissions are being made from an on board transmitter producing 100 watts or more of transmit power while operating in the range of 43 Megahertz (Mhz) to 900 Mhz. Proper RF suppression shall be provided by the manufacturer in any equipment and accessories that can produce interference to eliminate such interference. The vehicle frame and body shall be designed to provide no measurable radio interference (shielding) for improved radio emissions and reception performance. Certification of radio reception and transmission performance by the vehicle manufacturer as well as locations of components for installation of the radio packages for 43 Mhz to 900 Mhz shall be completed at pilot model production.
  - a. Two (2) antenna mounting plates (.060" steel minimum) shall be mounted in the roof of the coach for the purpose of providing a connection to the ground plane and providing a secure mount for the antenna. On buses with a metal exterior skin, one plate

shall be mounted forward of the roof escape hatch on the roof center line and the second plate shall be mounted to the left (driver's side) of the first plate just above the coach side window. For vehicles with FRP composite bodies, the mounting plates may be installed in the front cap of the vehicle--one centered in the roof section of the cap and one centered in the left (driver's) side section of the cap. Each mounting plate must be properly positioned in relation to its ground plane to ensure proper operation of an antenna installed at that mounting point. The total thickness of the exterior shell of the bus in the mounting plate area including the mounting plate shall be no more than  $\frac{1}{2}$ ".

- b. Two (2) antenna ground planes, which are required for proper antenna operation, shall be mounted in each vehicle. All ground planes shall be radio frequency (RF) grounded to the nearest metal portion of the body structure using high corrosion resistance and high conductivity braided ground straps of the proper size (1/4" minimum width). Ground planes shall provide a comparable area of radio transmission coverage whether vehicles have a metal exterior body covering or have a FRP composite exterior. At each antenna access opening and mounting plate area, the ground planes shall be of proper size and shape for proper communication operations. The ground planes shall be a solid piece and operate over the range of frequencies from 43 Mhz to 900 Mhz. The ground plane material used by the manufacturer must be a durable material that can be connected to the antenna mounting plate and grounded to the chassis frame. The ground plane shall be of the proper size to protect passengers in the vehicle from unnecessary radiation from the transmitting antenna at the vehicle's antenna access openings.
- c. A 6" high branch deflector shall be installed on the roof of the vehicle 6" forward of the antenna mounting area.
- d. Two threaded type access holes with covers approximately 6" in diameter shall be installed at the antenna mounting plate locations, one centered in the interior ceiling forward of the roof escape hatch and the second directly to the left (driver's) side above the side window line of the coach on buses with a metal exterior skin. For vehicles with FRP composite bodies, the screw-type access holes may be installed in the front cap of the vehicle, one centered in the roof section of the cap and one centered in the left side section of the cap. Adequate space shall be provided between the installed access cover and the inner body to allow for routing of the antenna lead and its connections without interference.
- e. A concealed thin wall plastic conduit, 5/8" I.D. minimum, (with antenna cable pull wire) shall extend from the antenna mounting plate locations (roof and above side window or in front cap) to the mounting location for the radio. When installed, the conduit shall have no sharp or right angle bends or be distorted to prevent insertion of the antenna lead. For both antenna

mounting plate locations, sufficient space shall be left at each end of the conduit to allow easy removal and replacement of the devices attached to the cable. The antenna pull wire shall terminate behind the driver's seat with 2 feet of extra length extending into the coach interior.

- f. 12-Volt Power for the Two-Way Radio - The positive lead (red 8 ga wire fused at 40 amperes) for the radio connection shall be provided directly from the battery positive post. The ground lead (black, 8 ga) shall be connected directly to the chassis frame with a bolt, external tooth lock washers, and nut for fastening. Proper suppression equipment shall be incorporated in the vehicle's electrical system to eliminate interference with radio and television transmission and reception shall not cause interference with any electronic system on the coach. The radio power and ground leads shall terminate directly behind the driver's seat with 12 feet of extra length extending into the coach interior.
- g. A split loom or other flexible wire race-way (1" minimum) shall be installed from the radio location to the dash mounted microphone control location.
- h. The modesty panel behind the driver shall be used for radio mounting and shall be constructed to support 60 pounds of weight. To provide for radio mounting, a 5" minimum distance shall be provided between the driver's seat and the modesty panel when the driver's seat is in its most rearward travel position.

## **VI. ALTERNATE QUOTES (OPTIONS)**

### **A. Air Conditioning System**

- 1. a. The air conditioning system (A/C) shall have a separate compressor, condenser, and evaporator unit for the front system and for the rear system (two separate systems). The systems shall use refrigerant type R-134A and be warranted from date of delivery for one full year, minimum. The systems shall be of sufficient capacity to maintain interior temperature requirements stated in the test procedure for air conditioning systems during summer operation. See required certification in Vendor/Manufacturer Requirements, Section VII. C.
- b. The front system shall be integrated with a compatible in-dash driver's area evaporator unit (complete front system may be Chassis OEM). The front system shall provide temperature control with sufficient cooling ventilators for driver comfort with no reliance on the rear system for front temperature control. Front and rear air flow and temperature shall be controlled by separate switches on the driver's control panel or dash panel. Front and rear systems shall have separate fan and compressor controls.

- c. Front and rear systems shall have separate computerized air conditioning protection system and diagnostic monitoring system or may have one integrated system that can monitor each system separately through the use of an electronic controller and its sensors. The system shall be able to monitor system voltage, high refrigerant pressure, low refrigerant charge, and clutch cycling intervals and shall protect the system by controlling compressor clutch engagement. The system shall be able to interpret associated problems and provide codes for technician diagnosis. Suggested source: APAds™ A/C Protection Systems by Index Sensors and Controls or equal.
- 2. Compressors: There shall be two engine driven air conditioning compressors of nominal 10 cu. in. displacement each, one for the front system (may be chassis OEM) and one for the rear system. Hose end metal fittings connecting hoses to the compressor shall be electro-coated steel that will pass the ASTM D117 1000 hour salt spray test. A/C system pressure monitoring switches (cut out switches) shall be installed in the system to provide compressor protection from extreme high and extreme low pressures. The compressor clutch circuit shall be interrupted when abnormal pressures are detected by the pressure monitoring switches. Low pressure switch shall be located between expansion valve and compressor. High pressure switch shall be located between compressor and condenser. Suggested sources: A.C. Industries, Thermo King, Trans/Air, or equal.
- 3. Condensers: The two systems' condensers shall be roof mounted or may have the condenser for the rear system roof mounted and use the Chassis OEM radiator mounted condenser for the front system. The protective external grille work for the roof mounted condenser coil fins shall not be mounted directly against the fins. The condenser fans and motors shall be enclosed within the condenser housing. The housing shall be galvanized with heat-fused powdered epoxy coating. The condenser coil shall be copper tube expanded into aluminum fins and vinyl-coated. Hose end metal fittings connecting hoses to the condenser shall be electro-coated steel that will pass the ASTM D117 1000 hour salt spray test. High pressure cut out switches shall be wired into the clutch circuit. The condensers shall be equipped with 10" axial fans dynamically balanced with permanent magnet totally enclosed motors. The condensers shall blow air upward and toward the rear of the bus assisted by the forward motion of the bus. The dryer shall be included in the system. A winter protection system shall be provided and approved by the State. A branch guard the same height as the condenser shall be mounted just forward of the condenser assembly on the roof of the vehicle which shall not restrict air flow into the condenser assembly. Suggested sources for roof mounted condenser: A.C. Industries, Thermo King, Trans/Air, or equal.
- 4. Evaporator(s)
  - a. The front (may be chassis OEM equipment) and rear evaporator(s) shall have three-speed continuous duty permanently lubricated blower motors (blower assembly rated at 1985 CFM). The evaporator cores shall be a copper coil with aluminum fins (four

rows deep, minimum), galvanized heavy-duty frame and coil end sheets with a galvanized drain pan. The evaporator expansion valve shall have "O" ring refrigerant connections. Suggested sources: A.C. Industries, Thermo King, Trans/Air, or equal.

- b. The driver's evaporator shall be controlled separately from the passenger area system and shall have a three-speed continuous duty permanently lubricated blower motor (may be chassis OEM equipment). The controls shall include on/off switch and a three-speed blower switch. In-dash unit shall not interfere with removal or replacement of the engine cover or be blocked by the entrance door control mechanism.
- 5. The passenger area air conditioning system shall be separately controlled from a control station at the driver's position (may be chassis OEM equipment). The controls shall include an on/off switch and a three-speed blower switch.
- 6. The components of the air conditioning system shall be readily accessible for maintenance. Service ports shall be accessible without removing any other component or item. The refrigerant hose construction shall comply/exceed SAE specification J2064 Type D or E. The construction of the hose shall include a nylon-based thermoplastic inner liner reinforced with two separate layers of textile yarn and a cover consisting of a synthetic elastomer in order to reduce incidences of chaffing, cuts, and ruptures with adequate extra length for flexing where connected to compressors and other components. Refrigerant fitting construction shall comply/exceed SAE specification J2064 Type D or E. All refrigerant hose end fittings shall be electro-coated steel that will pass the ASTM D117 1000 hour salt spray test. The hose coupling end of all fittings shall include two hose barbs and two areas of elastomeric or HNBR seals. Refrigerant hose clamp construction shall; comply/exceed SAE specification J2064 Type D or E, be made of stainless steel to ensure coupling integrity, properly align hose end fitting, and clamp the hose directly over the elastomeric or HNBR seals. Refrigerant hose fittings shall be Aeroquip E-Z Clip system, Carrier/Transicold Quick-Klik system, or equal.
- 7. The wiring shall meet all applicable specifications (see Section V. B.). The evaporator and condenser wiring (power and ground circuits) shall be properly sized to provide full battery voltage to each electrical unit.
- 8. Air conditioning electrical circuits shall be protected with automatic circuit breakers or thermal relays.

**B. Destination Sign**

A 12-volt destination sign with a motor driven movable sign curtain mechanism shall be provided which meets ADA requirements (one front sign and one side sign). The sign curtain shall be approximately 36" wide and illuminated. The front bulk head and other sign box shall have interior doors to open for viewing sign curtain position. The doors shall be

positioned for ease of driver operation. Suggested sources: Trans Sign Model D-3110 or equal.

**C. Ceiling Handrails**

1. Two full length transit-type ceiling handrails shall be provided and securely attached to roof structure on all buses used in fixed route service (line haul). The handrails shall be a minimum of 1¼" outside diameter, brushed finish, stainless steel including mounting brackets and fittings. All handrails shall meet ADA requirements for position and size.
2. All handrail mountings shall have reinforcement plates welded to or imbedded in structure behind surface panels of sufficient strength to withstand passenger force. Final locations shall be determined at pilot model production.

**D. Donation Box**

A donation box (to replace the farebox) shall be mounted on an adequately braced stanchion; shall be located over a flat floor surface near the driver; and shall be accessible to passengers entering bus (meet ADA requirements). The metal lockable donation box shall be supplied with two keys. (Location shall be approved by the State at pilot model production). Suggested source: Main Farebox Model C91M or equal.

**E. Limited Slip Differential**

The limited slip differential powers both wheels yet freely permits wheel speed differentiation when required during turning using standard OEM equipment.

**F. Rear Emergency Exit Window**

1. A bus equipped with a rear exit window shall have the window opening be approximately 1,200 square inches (opening approximately 20" by 60"). The rear window shall have a latching device for opening from the inside of the bus which may be quickly released but designed to offer protection against accidental release. Lever-type latches shall be used for rear emergency exit windows and shall secure the windows tightly shut, shall be easily operated, and shall not unlatch due to vibration during normal bus operation. The latches shall be made of non-corrosive materials and be designed for minimal maintenance needs. The rear window exit shall meet federal requirements (FMVSS 217). The rear window exit shall have an audible alarm at the driver's area energized when the window starts to open with the ignition on. A clear full width path of 16" minimum height shall be provided to the rear exit window. No objects shall be placed in bus which restricts passageway to rear exit window. All emergency exits shall be marked with instructions for proper use.
2. The bus rear exit window shall have a glue-on wide angle view Fresnel lens to improve vision directly in back of bus. Suggested source: Vanguard made by Optical Sciences Group or equal.



3. On buses with a rear exit window, forward facing seating for five passengers shall replace two double place forward facing seats at the rear wall of the passenger compartment increasing the passenger capacity by one. The five passenger seating shall be available for buses with the lift forward of the rear axle and those with the passive lift option (no wheelchair lift or securement location at the rear of the bus). The five passenger seat shall be 88" minimum width and shall comply with all requirements specified in Section II., Part P., Item 4. and Item 5. of these specifications but without grab handles. The seats shall be of the same design as the other passenger seats.

**G. Paint - Single Color**

The bus shall have a full body paint of one color only. This will be a deduct from the two color requirement.

**H. Paint - Extra Stripe or Roof Color**

In addition to the two color scheme, the bus shall have an additional single color stripe or a roof painted a different color. This will be a price increase. An example would be: a red bus with a 10" belt stripe having a second stripe applied or having the roof painted white.

**I. Type II Lift, Active (Platform) (Meet ADA Requirements)**

The Type II platform lift shall meet all of the lift requirements stated in Part II, Section Y except that the Type II lift shall have a power operated outer barrier on the lift platform. Suggested sources: Braun, Ricon, or equal.

**J. Entrance Stepwell Lift/Passive Step Lift**

1. This option will not be used in the evaluation of the total bid and is for information only. Availability of an entrance stepwell passive lift option is for demonstration or experimental units only (special purchase by the State). Persons with disabilities and persons without disabilities shall be able to board the bus through the same doorway (passive lift). The loading of wheelchairs and other mobility impaired persons shall be accomplished by a power level change mechanism (lift) incorporated into the front passenger stepwell area (to replace lift, Section II. Y.). The lift shall provide a lift platform which operates in the stepwell area. The lift may be a cassette style stored platform lift or a step lift that converts the entrance steps into the lift platform. Suggested sources: Braun, Mobile Tech, Ricon, or equal. The overhead clearance between the top of the door opening and the raised lift platform, or highest point of a ramp, shall be a minimum of 68" (to meet ADA requirement over 22 foot bus). The passive lift platform width shall be 32" minimum and the lift platform length shall be 48" minimum. The passive lift capacity shall be 600 lbs. minimum. The color of the lift shall coordinate with bus interior colors. The passive lift shall be compliant with all ADA regulations.

2. The passive lift may be a step lift (to replace lift, Section II. Y.) and, if so, shall convert the entrance steps into a lift platform and shall meet ADA requirements. The step lift shall be designed to form the platform and raise the platform to floor height or form the platform and lower the platform to ground level in a one button operation (starting from the step position). The three-step lift shall be incorporated into front passenger stepwell with the ground to first step 10" ( $\pm 1$ "). Each additional vertical step shall be 10" maximum, except second step shall be 10  $\frac{1}{2}$ " maximum. All tread depths shall be 9" minimum. The lift platform width shall be 35" minimum and the lift platform length shall be 48" minimum. The step lift platform and riser shall be stainless steel covered with RCA low flame rubber flooring (permanently secured) with contrasting stripe at step edges (meet ADA requirements). The lift capacity shall be 600 lbs. minimum. The passenger door opening width for passive step lift shall be 39" minimum. The lift shall have a safety device to hold the lift in the up position in event of a failure. The overhead clearance between the top of the door opening and the raised lift platform, or highest point of a ramp, shall be a minimum of 68" (to meet ADA requirement over 22 foot bus). Persons with disabilities and those without disabilities shall be able to board the bus through the same doorway.
3. The lift shall be designed to prevent dust, rain, or road splash from entering the step area when vehicle is in motion. Fasteners on the platform and the barrier shall be stainless steel.
4. The passive lift 12-volt power pack (electro-hydraulic) shall be installed according to lift manufacturer's instructions. If an electrical or mechanical failure occurs, the lift shall be designed to be operated manually.
5. The passive lift platform shall stop automatically when lowered to ground level. The platform must stop or descend in a slow even manner even if a failure occurs.
6. The passive lift platform shall include a locking safety device (meet ADA requirement) to prevent mobility aids such as The Amigo and other electric wheelchairs from rolling off. Lift platform handrails shall be of proper height and placement for maximum assistance to passenger use during entering and exiting.
7. The passive lift control shall be conveniently located on a flexible, cut resistant cable for easy operation from inside the vehicle, outside the vehicle, or while standing on the platform.

**K. Under Vehicle Lifts**

The under vehicle wheelchair lift (to replace lift, Section II. Y.) shall be for demonstration or experimental units only (special purchase by the State). This option will not be used in the evaluation of the total bid and is for information only. The lift assembly (including the power unit) shall be mounted under the vehicle floor on the right curb side. The wheelchair lift may be installed in a separate door opening or may be installed in the stepwell area. The overhead clearance between the top of the door opening

and the raised lift platform, or highest point of a ramp, shall be a minimum of 68" (to meet ADA requirement over 22 foot bus). When installed in a separate door opening, the door(s) shall be manually operated with an outside key locking handle. Fasteners or other devices shall be provided for the separate lift door(s) so that the door(s) can be latched or otherwise held in an open position. All door openings shall have full structural framing equal to the structural members of the body.

**L. Electronically Controlled Transmission**

The vehicle shall be equipped with an electronically controlled five speed transmission with lock-up torque converter and internal park pawl. The shift control shall have P, R, N, D, 3, 2, and L quadrant positions and automatically engage the park pawl when placed in the "P" position. Various gear ratios shall be used from 1<sup>st</sup> (approx. 3.5:1) to 5<sup>th</sup> (overdrive approx. 0.75:1). This option would be used in place of the standard four speed transmission. Suggested source: Allison 2000/2400 Series™. Availability of this option is for demonstration or experimental units only (special purchase by the State). This option will not be used in the evaluation of the total bid and is for information only.

**M. Natural Gas Application**

The vehicle shall accept Compressed Natural Gas (CNG) or Liquified Natural Gas application if required for fleet compliance by federal Environmental Protection Agency (EPA) alternate fuel application guidelines. Availability of this option is for demonstration or experimental units only (special purchase by the State). This option will not be used in the evaluation of the total bid and is for information only.

On vehicles ordered with alternate fuels options (propane, CNG, etc.) auxiliary heater systems installed shall meet the same specifications for the systems operating on diesel fuel. Additionally, a diesel fuel tank shall be added with a minimum working capacity of 8 gallons with a 1 gallon reserve. All heated air models shall have a 12 volt heater booster pump (Bergstrom 863040 or equal) installed in the coolant line forward of the first rear heater. Additional equipment needed for auxiliary heater shall be included in the option.

**VII. VENDOR/MANUFACTURER REQUIREMENTS**

**A. Vehicle Information Furnished - Vehicle information in this section shall be reviewed at the Pre-Pilot Model Review Meeting, at final pilot model production, and supplied with the each bus at delivery where indicated.**

1. Copy of manufacturer's statement of origin for a vehicle.
2. Warranty papers for chassis, body, and additional equipment with each bus at delivery.
3. As built drawings showing wiring schematics of all electrical circuits, body, and chassis with each bus at delivery.

4. Operator's manual for vehicle and all add-on equipment with each bus at delivery.
5. A complete set of repair manuals for the chassis and a manufacturer's parts manual for body, and auxiliary equipment for first bus of each model year delivered to each transit agency.
6. Bus operating instructions showing controls and operation on a VHS video cassette tape for each bus delivered to each transit agency.
7. Standard manufacturer's production option sheet(s)/decal(s) for chassis and body shall be installed in standard location, with no holes or rivets obscuring writing and numbers. Sheet shall include rear axle ratio. A paper copy of the service broadcast sheet for chassis shall also be provided with each vehicle at delivery.
8. Maintenance and inspection schedule incorporating the required maintenance and inspection of the basic vehicle and its subsystems (i.e., wheelchair lift) with each bus at delivery.
9. Detailed description and specifications of the frame structure, roof structure, side sheathing, and inside panels with particular reference to material used.
10. Detailed drawing on how body structure is mounted on chassis frame.
11. Proof of vehicle suspension alignment (work order or bill) at final vehicle inspection and with each bus at delivery. Four wheel alignment shall include adjustments to front/rear suspension and steering parts so that axle alignment, camber, caster, and toe settings are within manufacturer's desired limits.
12. Proof of undercoating (warranty) at final vehicle inspection and with each bus at delivery.

**B. Manufacturer Quality Control**

Vehicle Contractor/manufacturer shall provide a plan for quality control during vehicle construction and include the plan as part of the bid documents. Vehicle Contractor/manufacturer shall also provide the name of the chief of quality control for vehicle construction.

The Contractor shall establish and maintain an effective in-plant quality assurance organization. It shall be a specifically defined organization and should be directly responsible to the Contractor's management and completely independent from production. The quality assurance organization shall exercise quality control over all phases of production from initiation of design through manufacture and preparation for delivery. The organization shall also control the quality of supply articles. The quality assurance organization shall verify inspection operation instructions to ascertain that the manufactured product meets all prescribed requirements. The quality assurance organization shall detect and promptly assure correction of any conditions that may result in the production of defective transit vehicles. These conditions may occur in design, purchases, manufacture,

tests or operations that culminate in defective supplies, services, facilities, technical data, or standards. The Contractor shall maintain drawings and other documentation that completely describe a qualified vehicle that meets all of the options and special requirements of this procurement. The quality assurance organization shall verify that each transit vehicle is manufactured in accordance with these controlled drawings and documentation.

The Contractor shall ensure that all basic production operations, as well as other processing and fabricating, are performed under controlled conditions. Establishment of these controlled conditions shall be based on the documented work instructions, adequate production equipment, and special work environments if necessary. A system for final inspection and test of completed transit vehicles shall be provided by the quality assurance organization. It shall measure the overall quality of each completed vehicle. A system shall be maintained by the quality assurance organization for identifying the inspection status of components and completed transit vehicles. Identification may include cards, tags, or other normal quality control devices. Inspection stations shall be at the best locations to provide for the work content and characteristics to be inspected. Stations shall provide the facilities and equipment to inspect structural, electrical, hydraulic, and other components and assemblies for compliance with the design requirements. Stations shall also be at the best locations to inspect or test characteristics before they are concealed by subsequent fabrication or assembly operations. These locations shall minimally include, as practicable, under-body structure completion, body framing completion, body prior to paint preparation, engine installation completion, under-body dress-up and completion, vehicle prior to final paint touch-up, vehicle prior to road test, and vehicle final road completion and presentation to resident inspectors. Tests shall be performed by the vehicle manufacturer to ensure that the unit is dustproof, water-tight, fumeproof, and that all vehicle fluids are per specifications. The quality assurance organization shall be responsible for presenting the completed vehicle to the resident inspectors. Sufficiently trained inspectors shall be used to ensure that all materials, components, and assemblies are inspected for conformance with the qualified vehicle design.

The State may be represented at the Contractor's plant by resident inspectors. They shall monitor, in the contractor's plant, the manufacture of transit vehicles built under this procurement. The Contractor shall provide office space for the Resident Inspectors in close proximity to the final assembly area. This office space shall be equipped with desks, chairs, outside and interplant telephones, and other items sufficient to accommodate the Resident Inspector staff.

#### **C. Air Conditioning Certification**

1. Vehicle manufacturer shall provide air conditioning system performance certification (conducted by an independent laboratory or testing agency and supported by documentation of the actual test on the pilot model vehicle) that the air conditioning system installed in the vehicle meets or exceeds performance levels required by these specifications.

- a. The air conditioning system performance testing shall be conducted using a heating chamber of sufficient size to contain the basic vehicle, to heat soak the vehicle at 100°F for 4 hours minimum, to simulate sun load entering windshield, and to maintain 100°F exterior temperature continuously after heat soak during testing. An interior temperature of 72°F (±3°F) must be reached within 30 minutes from the beginning of the test. Engine speed shall be maintained at 1300 RPM (± 200 RPM) during the test.
- b. Instrumentation for temperature monitoring of the bus interior shall be a minimum of 3 points in the passenger area 30" above the floor - one in driver's area at knee level, and one at the evaporators' air inlets and air outlets. Instrumentation and recording equipment shall be able to monitor all points, record data at one minute intervals, and print a data report.

**D. Heating/Ventilating Certification**

1. The vehicle manufacturer shall provide test results that certify the performance of the heating/ventilating system as installed in the vehicle meets or exceeds performance levels required by these specifications. The test should be conducted by an independent laboratory or testing agency and supported by documentation of the actual tests on the pilot model vehicle. Testing may be performed in natural cold climate conditions.
2. The heating system performance testing shall be conducted using a cold chamber of sufficient size to contain the basic vehicle; to cold soak the vehicle at 0°F for 12 hours; to maintain 0°F continuously after cold soak during testing; and be equipped with a chassis dynamometer to simulate road operation under conditions encountered in normal transit operations with a 20% load of passengers, 1 wheelchair and a bus driver. An average interior temperature of 60°F must be reached within 30 minutes from the beginning of the test. After initial warm-up while the bus is in passenger service, the front and rear heavy-duty heating system shall be sufficient to maintain a minimum of 64°F at knee level throughout interior of bus and at the driver's foot space when the outside temperature is 0°F. The test procedures shall be completed: 1) to show actual temperature rise from static parked condition; 2) to simulate an average bus route; and 3) to measure coolant flow rates in the heater circuits at idle and at operating speeds.
3. The test is to be: 1) warm-up of 15 minutes with 8 minutes @ idle and 7 minutes @ 35 mph road load; 2) idle bus, 3 minutes [passenger boarding - door open for 1 minute]; 3) run @ 25 mph for 5 minutes, run @ idle 3 minutes [passenger boarding - door open for 1 minute]; 4) run @ 25 mph for 5 minutes, run @ idle for 8 minutes [wheelchair boarding - doors open for 4 minutes]; 5) 2 cycles of run @ 25 mph for 5 minutes, idle 3 minutes [passenger boarding - door open for 1 minute]; 6) run @ 25 mph for 5 minutes, run @ idle for 8 minutes [wheelchair boarding - doors open for 4 minutes]; 7) 2 cycles of run @ 25 mph for 5 minutes, idle 3 minutes [passenger boarding - door open for 1

minute]; 8) run bus at 35 mph for 6 minutes; and 9) idle bus, 5 minutes. Total test operation cycle of 95 minutes.

4. Instrumented monitoring for the bus interior temperature shall be a minimum of 3 points located front, center, and rear in the passenger area 30" above the floor -- one in driver's area at knee level 22" above the floor, at front heater's air inlets and air outlets, and at rear heater's air inlets and air outlets. Other temperature monitoring points shall be: engine operating (coolant); engine oil; engine outlet to heater; heater return at engine or radiator; and exterior ambient. Coolant flow shall be monitored from the engine outlet to the heaters and for coolant flow through each circuit to the heater unit. Normal engine operating temperature shall be reached 30 minutes into the test and shall be maintained throughout the performance test. Supplemental heat shall be supplied to raise engine to normal operating temperature if testing conditions fail to raise the engine to normal operating temperatures at 30 minutes into the test. The standard used for this test for normal engine operating temperature is determined by the engine manufacturer's specifications. Instrumentation and recording equipment shall be able to monitor all points, record data at one minute intervals, and print a data report.

**E. Purchaser Inspection**

The purchaser reserves the right and shall be at liberty to inspect all material and workmanship at all times during the progress of the work, and shall have the right to reject all material and workmanship which do not conform with the specifications or accepted practice. Where a resident inspector is used, upon the request to the quality assurance supervisor, the resident inspectors shall have access to the Contractor's quality assurance files related to this procurement. These files shall include drawings, material standards, parts lists, inspection processing and records, and record of defects.

**F. Warranty**

Warranty shall become effective on the date the vehicle is placed into service based upon agency notice to contractor. Warranty service performed at the manufacturer's facilities at the manufacturer's request shall have all costs covered by the manufacturer. Warranty for the vehicle shall be the following as a minimum:

1. Two (2) years unlimited mileage on chassis.
2. Two (2) years unlimited mileage on transmission.
3. Three (3) years/100,000 miles on body structure, exterior and paint.
4. Eighteen (18) months on lift.
5. Manufacturer's standard warranty, one (1) year minimum, on other add-on components and items.

6. Warranty shall start the date the vehicle is placed into service by the purchaser.
7. The chassis, body, and all add-on components shall be warranted by the successful contractor.

**G. Miscellaneous**

1. The vendor shall furnish the State with the delivery schedule of chassis to vendor and a delivery date of completed vehicles within 30 calendar days from date of order.
2. Any in-line equipment changes shall have prior written approval of the State.
3. The Vendor shall supply vehicle turning radius: wheel-to-wheel and wall-to-wall.
4. The vendor shall furnish warranty procedure instructions and necessary forms used for customers to obtain necessary warranty repairs.
5. The manufacturer(s) shall produce as the Pilot Model the first bus ordered by the State for its agencies. The bus shall be: 1) lift equipped; 2) air conditioned; and 3) the largest size on request by the transit agencies. All necessary testing and equipment placement shall be performed on the pilot before final inspection/acceptance by the State.

**VIII. BID DOCUMENTS**

**The bidder shall supply two copies of the following with the bid quotation.**

- A. A floor plan of the vehicle shall be provided indicating dimensions and showing the interior layout of the vehicle. The plan shall include wheelchair placement, stanchion locations, engineering calculated loaded vehicle axle weights, and be drawn to scale for all configurations.
- B. All bidders must supply Manufacturer's technical specifications for wheelchair lifts and wheelchair restraints. Manufacturer's sales literature is acceptable if it contains the technical specifications.
- C. Detailed engineering drawing for the design of the entrance door and door opening device (with drawings).
- D. Detailed engineering drawing for the design of the entrance step configuration (with drawings).
- E. A description of the manufacturer's chassis (specifications).
- F. The warranties for body, chassis, and drive train.
- G. A copy of the Bus Rollover Protection Test (FMVSS 220) results of the vehicle offered as specified in the bid.



- H. The required Federal Transit Administration (FTA) clauses shall be attached to bid quotation.
- I. The Michigan Bus Specification forms completed in detail.
- J. The technical data sheet including flammability and smoke emissions for the seat foam supplied.
- K. Seat frame salt spray, humidity and impact resistance and test results
- L. Certification test data showing that the seats, the seat belts, and the installation are in compliance with FMVSS-207, 208, 209, and 210 where applicable.
- M. Roof, sidewall, and flooring drawings showing structure and structural specifications indicating metal size and type used. Include side sheathing and inside panels.
- N. Detailed engineering drawing on how body structure is mounted on chassis frame.
- O. Certification that the wiring and the switches for air conditioning and all add-on components are adequate to withstand transient loads expected.
- P. Certification that the bus model offered is a 7 year or 200,000 mile vehicle and will meet the requirements of Federal Register Rules and Regulations 49 CFR Part 665, Bus Testing Program. Stating from § 665.13 Test Report and Manufacturer Certification, Section (b)(1) "A manufacturer of a new bus model or a bus produced with a major change in component or configuration shall provide a copy of the test report to a recipient during the point in the procurement process specified by the recipient". The Contractor shall provide a copy of the final test report to the State prior to the State's acceptance of the first unit (Pilot Model) delivered.

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IX. TABLE 1



## **X. BUS SEATING ARRANGEMENTS**

The 24-passenger nonlift bus and lift bus (25 foot bus) shall be supplied as requested in the following seating arrangements:

- A. 24 passenger with out lift
- B. 14+2 passenger with active lift
- C. 10+3 passenger with active lift

The 30-passenger nonlift bus and lift bus (29 foot bus) shall be supplied as requested in the following seating arrangements:

- A. 30 passenger with out lift
- B. 22+2 passenger with active lift
- C. 18+3 passenger with active lift
- D. 14+4 passenger with active lift

Drawings for the suggested seating arrangements are supplied on the following pages.

This specification was developed as a cooperative effort between the Michigan Department of Transportation and a committee of representatives from various Michigan Public Transit Agencies.

Upon request, this specification can be obtained in alternative format such as braille, large print, or audio tape. Contact Jerome Jonson, Michigan Department of Transportation, UPTRAN, at 517/335-2568.

